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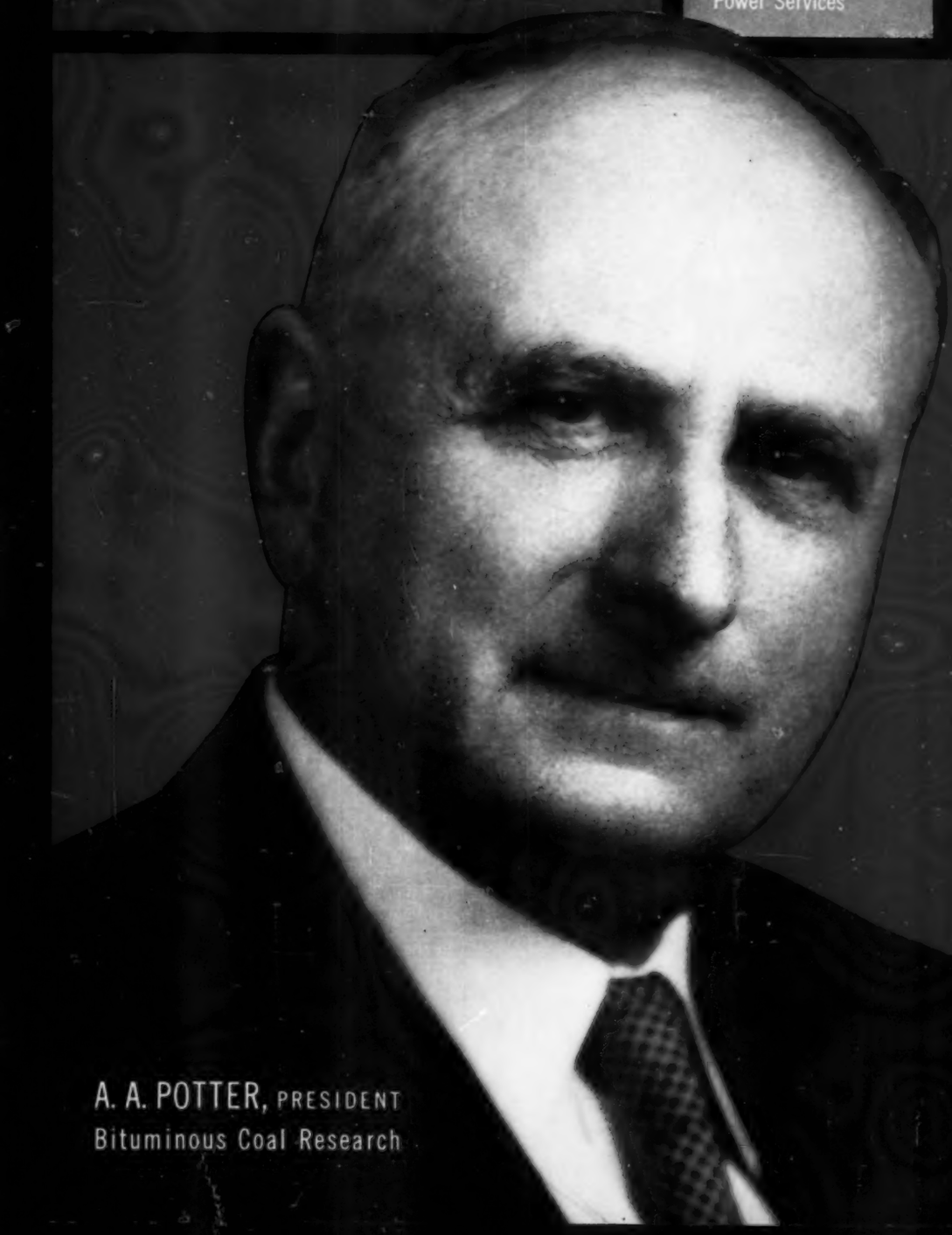
Industry Power

A Putman Publication | "Executive Magazines for Industry"

DECEMBER 1956

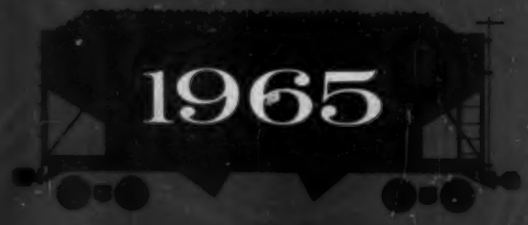
For Men Who Manage

Power Services



A. A. POTTER, PRESIDENT
Bituminous Coal Research

Estimated bituminous coal production . . . 860 million tons

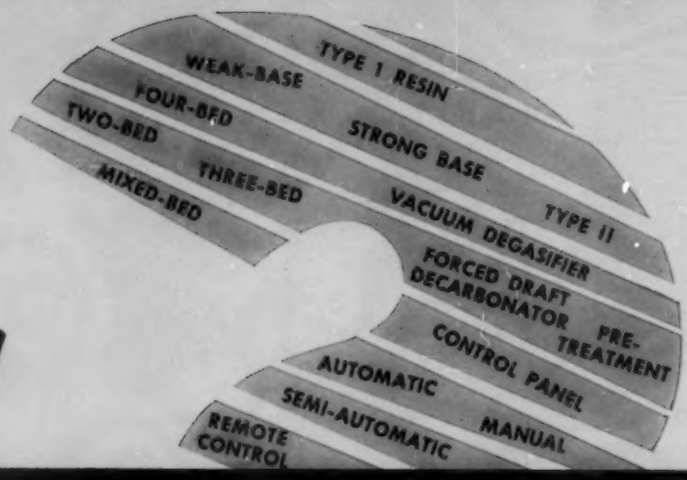


Estimated bituminous coal production . . . 600 million tons

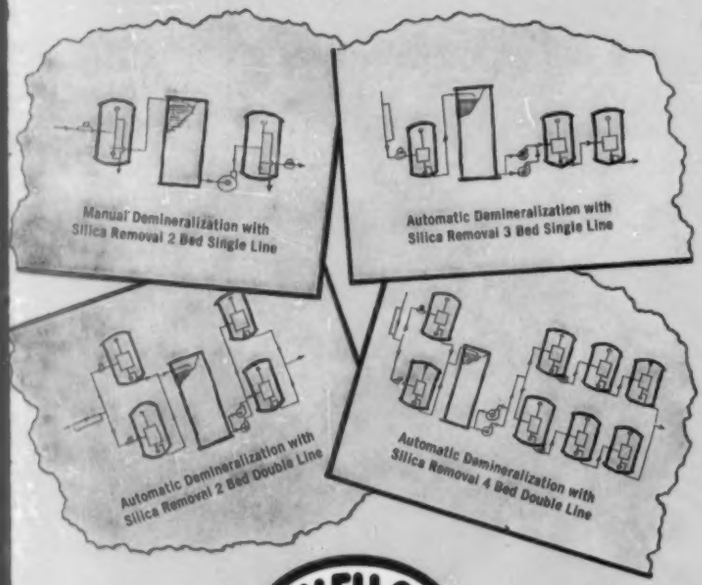
Estimated bituminous coal production . . . 474 million tons

COAL'S NEW HORIZONS
. . . SEE PAGE 3

*WHAT'S YOUR PROBLEM in DEMINERALIZATION



*INFILCO demineralizers are custom-built to solve the specific problems of each power plant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*The one best design for equipment to demineralize boiler feed water make-up depends on the characteristics of the water to be treated, boiler pressure and design, quantity of make-up required and many other variables peculiar to each installation. The best solution for one plant may be a manually operated two-bed demineralizer; in other cases three-bed, four-bed or mixed-bed demineralizers—manual or automatic—may be indicated.

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late news

. . . about industry power

• Plan smaller groups at 1957 plant show

Smaller meeting groups to permit more intimate discussion of factory problems are planned for January s Eighth National Plant Maintenance & Engineering Conference in Cleveland, Ohio. Ten sessions will be devoted to maintenance problems of particular industries . . . . including metal working, metal fabricating, chemical, and food processing plants; foundries; petroleum refineries; steel and textile mills; paper mills and paper product plants; rubber mills and rubber product plants. Maintenance welding has been added as a new topic this year. Conference will be held at the same time and place as the annual Plant Maintenance & Engineering Show. More than 400 companies will exhibit at the show. Exhibit area tops 100,000-sq ft mark for the first time.

• Complete 108-mile coal pipeline

Nation's first coal pipeline has been completed by William Brothers, pipeline contractors, working at a rate of 2½ miles a day. Line extends from Pittsburgh Consolidation Coal Co. mines near Cadiz to The Cleveland Electric Illuminating Company's new Eastlake steam power plant. Coal will be pulverized as it comes from the mine, mixed with water, and pumped through the line as slurry. At Eastlake it will be dried and burned. Pipeline will supply 3200 tons a day to CEI's plant. This represents approximately 80 percent of the new plant's total fuel requirements.

• Advocate pre-employment hearing tests

Pre-employment hearing tests were advocated by Robert A. Ewens, executive director, Wisconsin Manufacturers Association, at the National Noise Abatement Symposium in Chicago last month. This will help fix employer responsibility in states with hearing loss compensation laws. "A pre-employment audiometer examination is at least a starting point. A person may be 20-percent defective in hearing when he is hired and 10 years later, due to either noisy environment or some other cause, may be 25-percent defective. His employer will know at least that he is not responsible for the first 20 percent," Ewens explained. Allis-Chalmers makes pre-hiring tests and has found that one quarter of job applicants have some hearing defect.

(more late news on page 8)

Industry Power

FORUM

Coal's new horizons

A. A. POTTER, President
Bituminous Coal Research
with H. A. Bergen, Editor

About A. A. Potter*

Leadership is an art, and like any art it is individual. Personality, power of persuasion, clarity of expression, industry, and mastery of one's specialty are important factors, but character and sensitivity to human values are the major essentials of any leader, whether he is engaged in business, industry, education, or government service. The great leader understands and appreciates people. He shows his interest in and his respect for the individual in his organization by his kindness and courtesy, by his candor and fairness, his tolerance and understanding, by his optimism and unlimited patience. . . .

The good executive knows the people who make up his organization and treats those in the minor as well as the major posts with equal consideration, constantly studying the individual's potentialities while endeavoring to uncover possibilities as well as actualities. He is loyal to those below him as well as to his superiors. . . . He does not try to do it all himself, but delegates, supervises, and holds others for results. He knows what goes on and keeps subordinates as well as superiors fully informed.

The leader has unbounded enthusiasm for his organization and its product; his associates, subordinates, and superiors; his profession; and for the U.S.A. He is a good finder and not a fault finder, an optimist and not a pessimist.

He impresses those whom he contacts by the clarity of thought, action, and expression, by the vibrance of his voice, the sparkle of his eye, his vigor, and general animation. He has a sense of humor coupled with an understanding heart. His general education, his professional attainments, and his culture command the respect of his organization.

He is open-minded, orderly, emotionally stable, is willing to assume responsibility and be accountable for results, puts first things first, adheres strictly to lines of authority, and has ability to meet new situations courageously and resourcefully.

**The words we find most apt about A. A. Potter are these he composed himself for the guidance of others as part of the Fifth Frank A. Howard Lecture, which he delivered at George Washington University one year ago.* H.A.B.

OUR ENERGY DEMANDS will increase during the next 25 years by at least 20,000 trillion Btu over present-day use. Today's estimates of energy requirements in terms of bituminous coal are:

Year	Estimated Energy Requirements (Equivalent Tons)	Estimated Bituminous Coal Production* (Actual Tons)
1955	1580 million	474 million
1965	1990	600
1975	2530	760
1980	2863	860

*Assuming bituminous coal's contribution to total energy market remains 30 percent, as at present.

Look for research by the coal industry itself to create new horizons for bituminous coal, bolstering the otherwise growing demand for it. Because, for example, 90 percent of the underground coal mined in this country is machine-cut and 80 percent is machine-loaded, research in coal preparation becomes more important. More than half of our bituminous coal now passes through a preparation plant. Look for more effective coal preparation in the future. Look for increasing research that will show how to better remove objectionable ingredients in coal. Look for research into electrostatic precipitation in coal preparation. And look for research into more efficient refuse disposal from preparation plants . . . . including market development for fines.

On another front, research will continue to be applied to develop practical and economic processes for gasifying underground the poorer grades of unmined coal. (The Russians, incidentally, claim to have a working underground gasification system, although I am skeptical of its economic advantages.)

On still another front, look for research into geophysical methods for finding and appraising coal deposits. Look for mining machinery that will operate longer between maintenance periods.

Research along these lines will help keep the price of coal down. For on the basis of present figures, and neglecting increased thermal efficiencies that are sure to come for coal-burning plants, the coal-fired power plant could use $4/ ton coal for at least 20 years before nuclear power plants would begin to catch up economically. It is a fact, today, that bituminous coal supplies about 72 percent of the thermal plant requirements for electric power generation. Increased market of coal for electric power generation will follow from expanding use of electric energy, from availability of coal-burning equipment at a cost competitive with other fuels, from uninterrupted coal supply, from dependability of coal-burning equipment, and from satisfaction with coal as compared with other forms of energy. Look for more research to protect and increase the market for coal in small industrial plants as well as in space heating of commercial buildings.

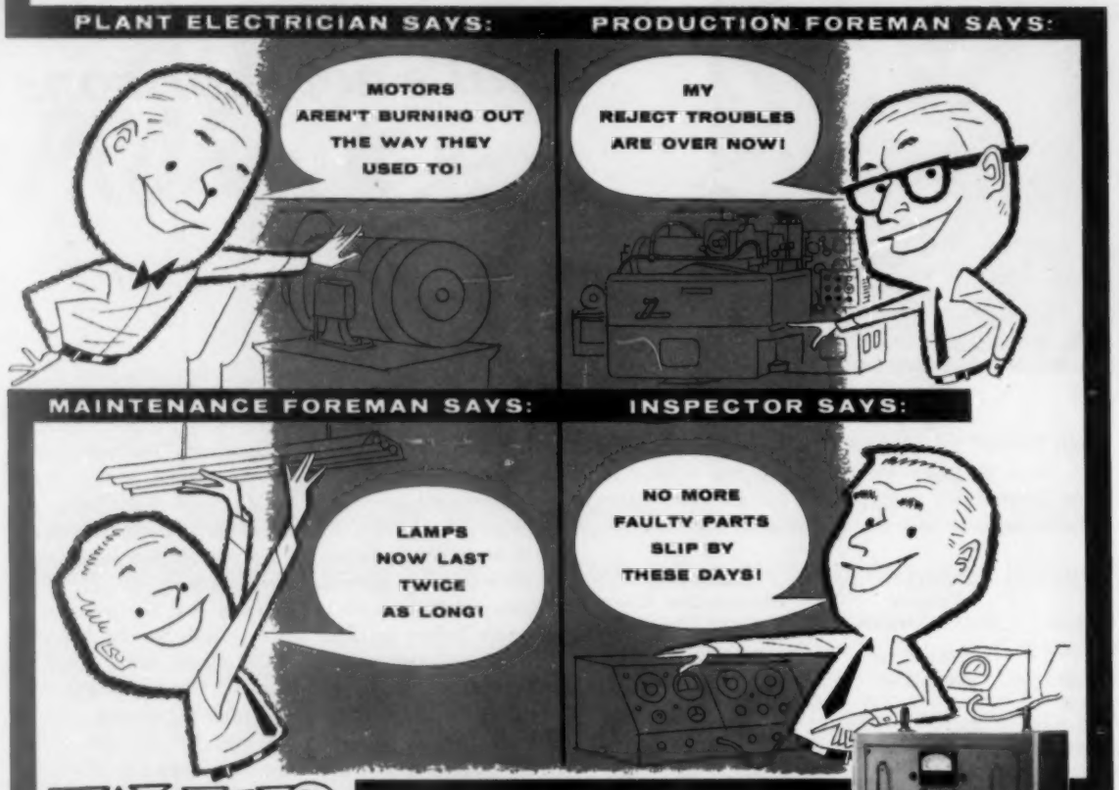
Farther out on the horizons for bituminious coal, we can see a day when coal could be worth $50 to $60 per ton on the basis of its volatiles valuable for chemical production. The day may come soon when we will despair of burning coal for heat *before* extracting gases of chemical value.

Research may pave the way to a horizon where our steam-electric plants will operate merely as disposal units in a chemical process. Heat for steam generation would be an inexpensive byproduct from a process producing a great array of chemicals and gases evolving from the raw coal.

High-Btu gas for pipelines will be needed in the not-too-distant future to meet needs in areas remote from natural gas sources. Coal hydrogenation, converting coal to liquid and gaseous fuels, will merit

(continues on page 8)

what these people say can **SAVE YOU MONEY**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A PUTMAN PUBLICATION

Industry Power

FOR MEN WHO MANAGE POWER SERVICES

VOLUME 71 NO. 7 DECEMBER 1956

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Flexibility and ease of expansion mean much to a growing plant. Here's how Rapids-Standard Co. uses a battery of package boilers to obtain heating system flexibility and to meet plant expansions.

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When Lincoln Electric Co. moved to its new plant, air capacity was ready for every conceivable application. New uses for this power service can now be incorporated without major modifications.

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This Bulletin may help you solve an important PUMPING PROBLEM!

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YARWAY picked for "Preferred" Steam Generators

This installation of Preferred Utilities Mfg. Corp. packaged unit steam generators at a high school in New York State features YARWAY Blow-Off Valves as part of the "package".

Not only Preferred Utilities, but many other leading manufacturers of package-type boilers now furnish YARWAY Blow-Off Valves on their units. YARWAYS make a *good* package boiler *better*.

The YARWAY Seatless Valve gives drop-tight shut-off and also eliminates the commonest source of blow-off valve trouble. *There is no seat to score, wear, clog or leak.*

Whatever make boiler you use, specify that the blow-off valves be YARWAY *Seatless*. More than 16,000 boiler plants use YARWAY Blow-Off Valves—some for 35 to 40 years.

Write for full details in Yarway Bulletin B-426.

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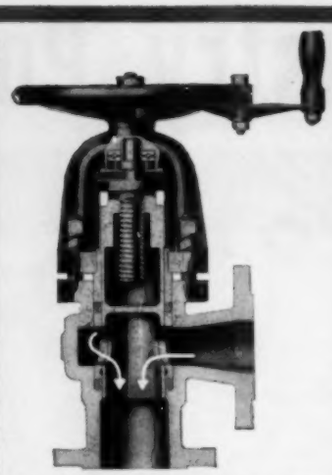
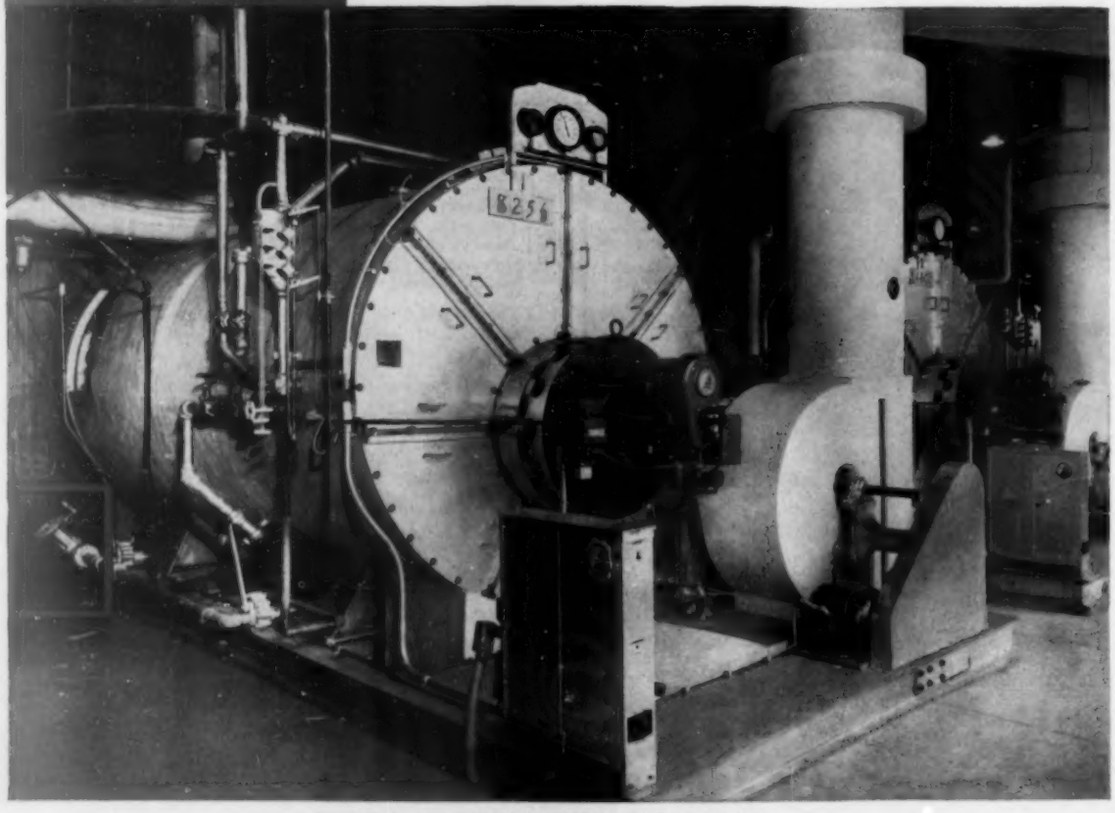


Yarway Type "B" Seatless Blow-Off Valve shown in open position. Note balanced, sliding plunger design. There is no seat to score, wear, clog or leak. Pressures to 400 psi.

YARWAY **BLOW-OFF VALVES**



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nuclear news

. . . about industry power

MORE U.S. NUCLEAR ACTIVITY ABROAD

Babcock & Wilcox has contracted to design and engineer a nuclear research reactor for the Society for the Utilization of Nuclear Energy in Shipbuilding and Navigation, in Hamburg, Germany. . . . AEC and the Export-Import Bank of Washington have agreed upon joint action to assist construction of atomic power plants abroad. . . . General Electric and General Nuclear Engineering Corporation will design, manufacture, and furnish consulting engineering services to Venezuela for its first atomic reactor. . . . Sylvania will supply atomic fuel elements to the Canadian government's new test reactor at Chalk River, Ontario.

FIRST PRIVATE INDUSTRY RESEARCH REACTOR

Westinghouse Research Laboratories will add a new nuclear research reactor to its facilities . . . the first such reactor to be built by an industrial firm solely for its own research use. Completion is planned within the next two years.

NAVY TO GO 100-PERCENT NUCLEAR

All naval vessels and some types of commercial ships built after 1960 probably will be nuclear powered, according to Stuart McClain, associate director of Argonne National Laboratory. He said it is probable that very large tankers built after 1960 will be nuclear powered, with reactors in other commercial shipping coming at a slower rate. "The use of reactors to power locomotives does not appear to be practical because of the hazards involved," McClain said.

PIQUA GETS REACTOR PLANT

Negotiation for initial design and development has been authorized between AEC and the City of Piqua, Ohio for a 12,500-kw nuclear power plant. Piqua's plant will use a circulating organic fluid as moderator and coolant. Slightly enriched uranium will be the fuel. Piqua proposes that the AEC finance and retain title to

the reactor, expected to cost some $4 million. Post-construction research and development assistance up to some $3.5 million would also be borne by AEC. Piqua would furnish land, buildings, turbogenerator, and other conventional facilities valued at some $4 million. Piqua would pay AEC for steam produced, would bear all operating costs other than fuel use charges, and furnish reports as required by AEC. In addition, Piqua would have an option to purchase the reactor after five years' operation.

REACTOR SCHOOL DOUBLES ENROLLMENT

Proposals from colleges and universities to establish and conduct courses in nuclear reactor technology have been invited by the AEC. This is part of a program to double the number of nuclear reactor engineers trained each year at the Oak Ridge School of Reactor Technology. The increased program would produce two classes of 120 reactor engineers per year.

NUCLEAR MANPOWER SURVEY UNDER WAY

Atomic Industrial Forum will launch the first part of a four-part manpower study for the AEC. Study will determine current manpower supply and prospective needs in relation to private industrial atomic energy activity. Among ten principal fields to be probed are power reactors and nuclear fuel.

AWARD WESTINGHOUSE YANKEE REACTOR

Westinghouse Electric Corporation will develop the nuclear reactor for Yankee Atomic Electric Company's new 134,000-kw pressurized-water reactor plant to be built near Rowe, Mass. Yankee, a combine of 12 major New England electric power companies, expects initial operation by 1960. Price tag on the plant is $35 million. AEC will provide $5 million for development of the nuclear reactor core. ♦ ♦

Is it strange . . . .
that you should receive a magazine such as INDUSTRY POWER without being subjected to the formality of a token subscription payment? Not at all. For the reasons why . . . .
see page 28

To 500F it's J-M Interlocked

because it cannot ravel or come apart

Made by an exclusive J-M process, Interlocked packing is braided from tough long-fibre asbestos yarns strongly interlocked in a solid integral structure. There are no jackets to wear through . . . no plaits to loosen. That's why it retains its strength and efficiency far longer than other types.

Interlocked also seals better. It is flexible and resilient, braided square for better contact and requires less gland pressure. Style 255 is effective against steam, hot or cold water, oil, weak acids and caustics. Furnished lubricated and graphited in ring and coil forms in sizes from ¼" and up.

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because it does not harden under high heat

Designed specifically for superheated steam between 500F and 750F, Johns-Manville's Superheat packing is made of highest quality pure asbestos cloth which retains its resiliency even after long exposure to high temperatures. Woven tight, spiral wrapped and then pressed square, this cloth forms a firm resilient structure of superior strength and wearability.

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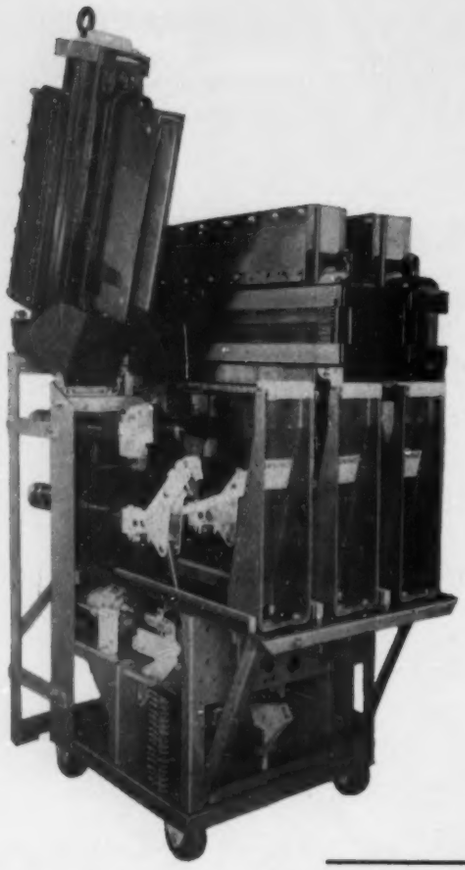

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I-T-E Type	Continuous Amperes	Rated KV	Interrupting MVA
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5HV-150	600-1200-2000	4.16	150
5HV-250	1200-2000	4.16	250
5HV-350	1200-3000	4.16	350
7.5HV-250	1200-2000	7.2	250
7.5HV-500	1200-2000	7.2	500
15HV-150	600-1200	13.8	150
15HV-250	1200-2000	13.8	250
15HV-500	1200-2000	13.8	500
15HV-750	1200-2000	13.8	750

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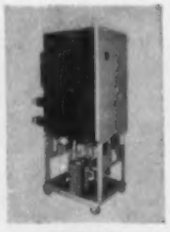
5HV-75



5HV-350

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coal's new horizons

. . . starts on page 3

intensive research soon. Magnitude of the coal market to meet needs for synthetic liquid and gaseous fuels is enormous. To replace even 5 percent of the present demands for natural gas and petroleum with synthetic coal-derived products would require more than 100 million tons of coal per year. Intensive research can reduce cost of liquid and gaseous fuels from coal, and can hasten the day when coal will become a competitive raw material.

We see, then, that the market as presently constituted for coal will increase due to increasing needs for energy. Coupled with this growing energy demand is research that will make coal more attractive and economic to use plus research that will develop new horizons for coal that have yet to be dreamed. ♦ ♦

late news

. . . starts on page 2

• Set another new business record

Sales of $432 million in the first nine months of 1956 as compared to $396.5 million in 1955 set a new record for Allis-Chalmers. Net earnings after preferred stock dividend requirements were about 12½ percent lower for the same period, however.

• TVA steam power increases from 14 to 65%

Preponderance of steam power in the TVA system has resulted from the great demand for electric power over recent years, Clarence E. Blee, chief engineer of TVA recently told ASCE. Present installed capacity of TVA power system is 10,291,000 kw, of which 6,714,000 kw (or 65 percent) is steam-electric power. In 1949, when the present steam plant extension program started, steam power on the system amounted to only 14 percent of the total. Normal power demand to supply growing residential, commercial, and industrial requirements has been greatly augmented by enormous demands of the AEC and other Federal agencies. Only feasible way to keep pace with these demands was to install large steam stations where one unit might have a capacity equal to an entire hydro station. This led to a program wherein seven large steam plants were under construction at one time. This rapid construction program helped develop and improve construction methods and techniques. For instance, man-hours required to erect a boiler in the earlier program stages were reduced later by as much as 40 percent. ♦ ♦

that's interesting

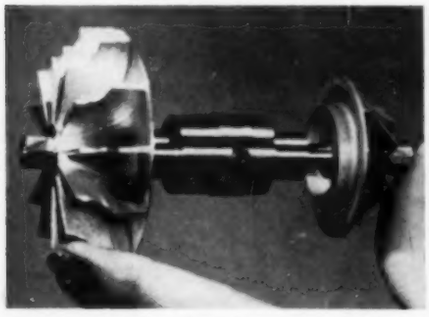
. . . for industry power

Be alive after 5

A new institute is now in business to serve all types of industrial concerns. For the first time, a group of professional people in scientific and health fields are offering an international service to everyone who makes or uses a device for holding the human form in a sitting position. Companies can receive valuable tips on seating to improve employee efficiency and a free plant survey on proper employee seating. Executives, office workers, professionals, or employees can be new people after the "Be Alive After 5" course of 15 unique lessons.

Midget air conditioner developed

Tiny jet-powered refrigeration unit whose working parts can be packed into a ladies' handbag has been developed by Carrier Corporation for use in the air conditioning system of Douglas Aircraft Company's new DC-8 jet airliners. Two units, each powerful



enough to cool seven average-size homes, will be used in each plane. Unit weighs less than the average male passenger. Air bled from engine moves a tiny turbine about the size of a mason jar lid, which in turn spins centrifugal refrigeration compressor rotor. Impeller wheel is little larger than a silver dollar. Top speed of rotor blades is half again as fast as that of sound passing through refrigerant.

Unlimited shelf life battery

New solid electrolyte battery with practically unlimited shelf life has been developed by National Carbon Company. Designed for low-current applications, battery weighs one quarter ounce and is made primarily of silver, silver iodide, and vanadium pentoxide. Extensive tests show battery should give up to several decades' continuous service in suitable applications, such as maintaining a charge on capacitors in electronic circuits. Battery consists of 200 paper-thin cells and is rated at 95 volts.

In water conditioning... one grows taller than the rest!

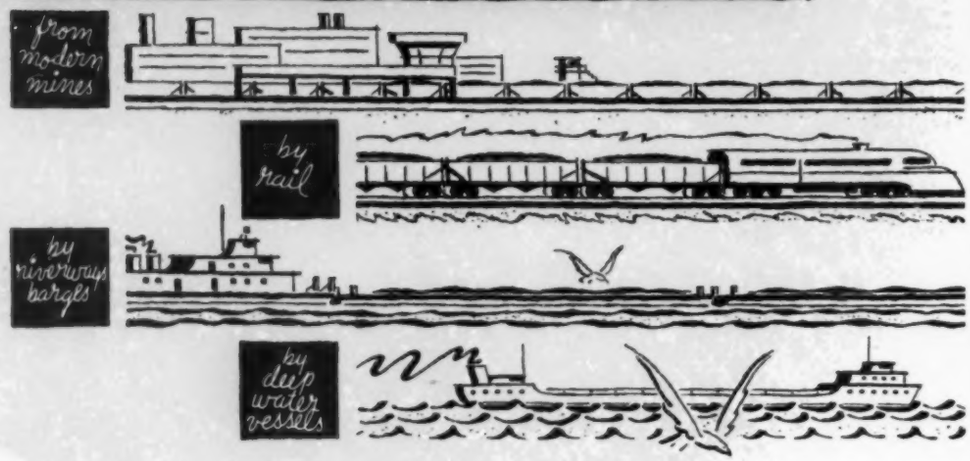
BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

W. H. & L. D. BETZ, Philadelphia, Pa.

a trust fund of coal

FOR INDUSTRY'S FUTURE NEEDS!



With industry's estimated power needs increasing 500 percent every 25 years, the Peabody-Southern Coal Companies are steadily expanding coal production now exceeding 20 million tons annually. New ultra modern mines and preparation plants are being added to keep pace with the increasing energy demand. Some 2 billion tons of reserves offer ample tonnages to support the Peabody-Southern expansion program. *These tremendous resources are strategically located in leading fields providing economical delivery by rail, by barge, or rail-to-water to all Mid-America. Protect your heavy investments in power plant and manufacturing facilities.

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Industry Power

Commercial Bank Building, Saint Joseph, Michigan
Telephone: YUkon 3-5515

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- Advertisements are indexed by products in handy guide. See page 49.
- Important literature is indexed by products. See page 42.

this month's comment . . . .

how we can get more engineers

By any yardstick we choose to use, or by citing any authority we we wish to respect, there is a shortage of engineers. . . . to one extent or another. Among the common mutterings and the halfhearted platitudes, at least one voice does not pussyfoot. That voice says this. . . .

"In terms of the law of supply and demand, what we call a shortage of engineers could be described as a depressed wage scale for engineers. And a substantial increase in engineers' wages would exert corrective influences. Because engineers and scientists would be more expensive, employers would use them more carefully than they do now. Because they would use them more carefully, we would not need as many. And because there would be greater rewards for those who succeed, a larger supply would develop. The net result would be that supply and demand would be brought into equilibrium."

This is the voice of an honored and respected engineer. . . . Fredrick E. Terman, provost and dean of engineering, Stanford University.

If Dean Terman's analysis is accurate, we must ask: *"Who* is depressing the wage scale for engineers?"

Now, an oft-overlooked fact is that most engineers are hired by other engineers. And the hiring engineers set the maximum wage for their subordinates with the salaries they are content to accept for themselves. Any shortage of engineers due to a depressed wage scale, therefore, is a shortage attributable to engineers themselves. Any depressed wage scale foisted upon engineers is attributable to the wage pattern set by those upper-echelon engineers who hire the vast majority of engineers on private and public payrolls.

We contend that if there is an engineering shortage (and our own experiences tell us that there is), we must look to ourselves as engineers to raise depressed wage scales. We engineers meekly submitted to low wages during the Great Depression of the Thirties. Today, we fail to recognize that the Great Depression is over.

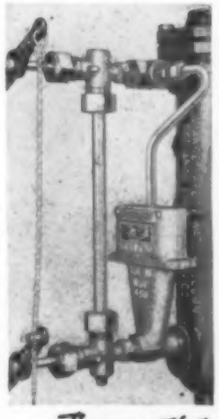
If upper-echelon engineers will not take their case to top management, top management cannot be criticized for depressed wage scales. Certainly, we cannot expect astute top management to spend any more payroll dollars than necessary. If we see a shortage in our ranks, we as engineers must take the initiative to establish wage scales that will wipe out the shortage. That is how we can get more engineers.

Harold A. Bergen
Editor

Small Device Does Big Job!
Here's all that shows of the Reliance Electrode-type Levalarm

Cap removed showing electrode connection fittings

Boiler water connects own alarm system and fuel cut-out . . .



Isolated circuits make relays work for you to actuate...

low water alarm — pump start
high water alarm — pump stop
fuel cut-out

(or selection of these facilities)

Upper photograph—Levalarm for pressures up to 2500 psi.
Lower photograph—Fuel cut-out Levalarm on water column. Can be installed in field.

Write for Bulletin D2.

The Reliance Gauge Column Company
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The name that introduced safety water columns....in 1884

Reliance®
BOILER SAFETY DEVICES

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Automatic control and built-in flexibility
give Rapids-Standard Company, Inc., steam

Packaged for expansion

RUSSELL A. INWOOD
Vice President, Manufacturing and Engineering
Rapids-Standard Company, Inc.

with R. W. De Moss, Assistant Editor

FACED WITH A NATIONAL DEMAND to increase production, we had to more than double our Plymouth plant area and increase heating capacity accordingly. Part of this problem was to find boilers that would not only function satisfactorily at the time but would continue to serve us during future expansions.

We decided on package steam generators, which had already proved satisfactory in our experience. Two 100-hp low-pressure boilers (York-Shipley Steam-Pak SPL-100-6) had been heating the plant since 1948. These were housed in a separate 35 by 80-foot building. We did not build a new boilerhouse or enlarge the one we had to secure additional steam capacity. All we had to do was to add two more package boilers. Building was originally designed for three boilers. We discovered that four boilers could fit in very nicely with little change in spacing.

how two package units filled our need

We bought two Steam-Paks (SPL52-125-5). They are the same physical size as the original pair but have 25 hp more, each. They were installed in October 1953, just five years after the first two had gone into service. Installation was simple. No chimneys were needed. No foundations had to be dug. All we did was to move in factory-engineered heating units and make necessary connections.

A second underground oil storage tank was added and a blowdown trench was dug. This work was done under the direction of Everett Lane, Power Services engineer.

Previous blowdown (to a sewer) had been unsatisfactory. Now the four boilers are connected to a common header that blows into a trench 50-feet long, 4-feet 6-inches deep and 2-feet 6-inches wide. Trench sides are concrete-lined, but the bottom is unlined for drainage. We have never seen a blowdown trench quite like this, but it does its job perfectly and we have had no trouble with drawings.

We feel that our present equipment is capable of heating a plant 1½ to 2 times our present size. We do not anticipate that this will be our last plant expansion. Our 16-acre site gives us plenty of room for future plant enlargement. The end wall is made of demountable panels and can be removed whenever more production space is needed.

Plymouth plant uses a radiant-heating system as flexible as its end wall. We can add to it at any time without disturbing, in the least, the present arrangement. It was doubled in size when we enlarged the building in 1953. At present, well over 100,000 sq ft of floor space are heated. This requires 70,000 linear feet of welded piping for hot water circulation.

Floor grids are constructed of ¾-inch parallels (standard-weight steel pipe) running between 1¼-inch headers. Grids are laid out in unit areas, which vary in size according to plant location. Floor grid lengths range up to 140 feet. Interior plant areas have unit grids comprising about 40 parallels spaced at 2-foot intervals. In grids for the plant perimeter, where temperature drops more rapidly during the heating season, we use fewer parallels in each grid and space the parallels more closely. A fair, average size for a unit grid area is 60 by 100 feet.

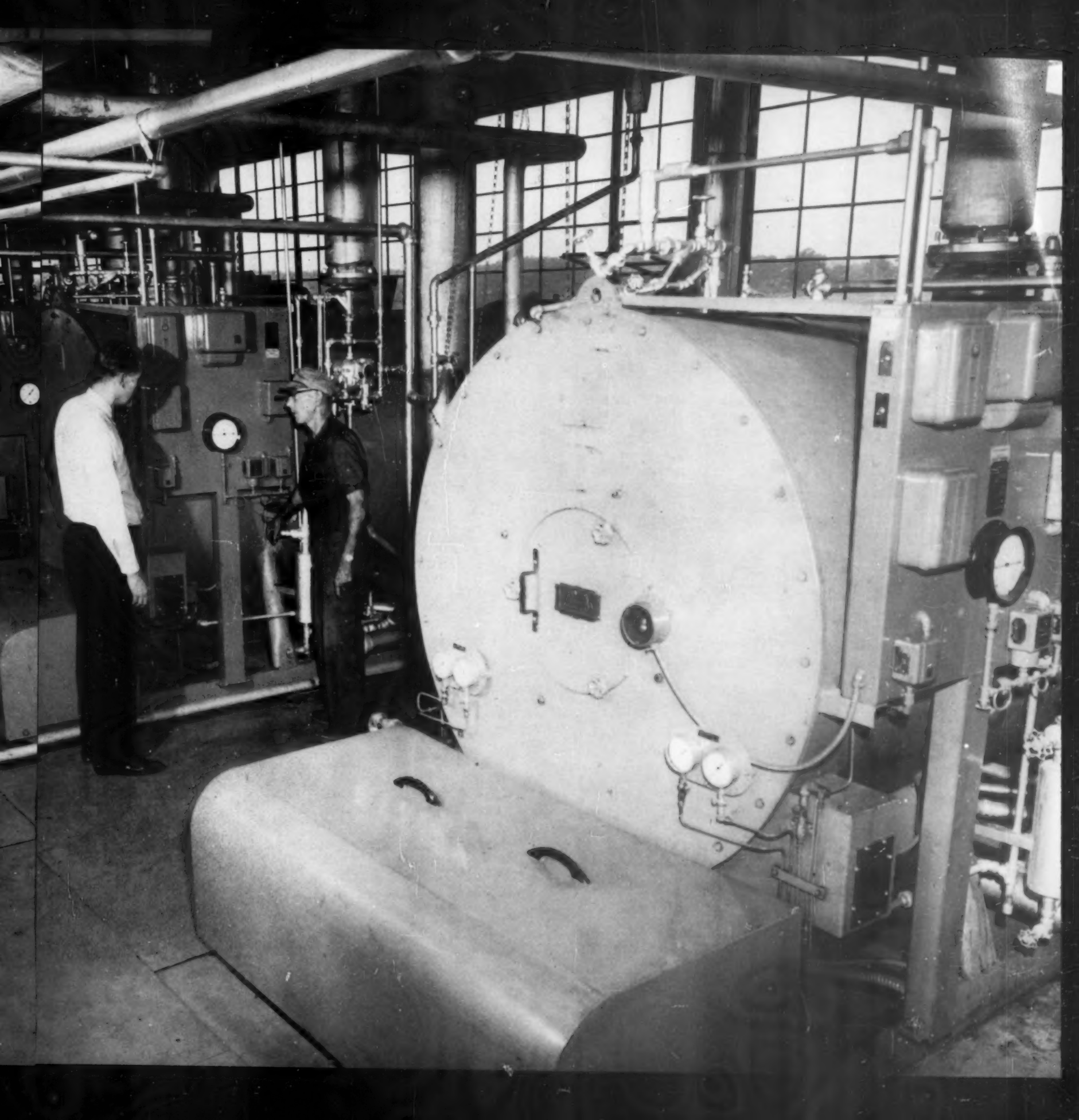
each area has separate control

Area temperature is controlled by space thermostats that operate individual hot water circulating pumps to supply area's heat demand.

Steam for the radiant-heating system is piped overhead into the main building to 23 overhead heat exchangers mounted in rows along each side

(continues on page 26)

Everett Lane, power services engineer (left), and J. Van Gemert, operator, check boiler plant operation.



To meet today's trend toward more power per unit of production . . . .

Lincoln Electric DOUBLES Compressed AIR Capacity

HARVEY KEHL
Maintenance Superintendent
The Lincoln Electric Co.

with R. W. De Moss, Assistant Editor

ANTICIPATING COMPRESSED AIR becoming more important as a Power Service delivering energy for production, Lincoln Electric Co.'s new plant has built-in flexibility in its compressed air system. New compressed-air system is double previous system capacity, although production floor space has been increased only 70 percent.

We figured to greatly increase production per acre of space in the new plant by using much more efficient layout and many innovations in materials handling. This factor alone demanded greater compressed-air capacity. But more than that, we wanted to take advantage of recent advances in design and application of compressed-air equipment—air-operated jigs and fixtures, hand tools, automatic pick-off devices on conveyor lines, and adjustable ramps at truck docks.

compressed air permits superheat

We decided, also, to use compressed air in the hot water system for plant heating. Air for plant heating system is introduced into a large pressure tank in the equipment room near the compressors. This cylindrical tank, 4-feet in diameter by 15-feet long, is normally kept half full of water. Normal water pressure is 70 to 75 psig. Introducing compressed air brings pressure in the tank up to the

Author Harvey Kehl makes routine inspection of pressurized tank in the hot-water heating system.

plant air system pressure of 100 psig. This maintains water in the system at a superheated 300 F. Compressed air is also used to automatically control heating outlets with air motors.

air outlets every 10 feet

To provide air outlets in the welding equipment manufacturing side of our plant for any future changes in production layout, an air line runs down each row of columns (column rows form bays 60 feet wide.) This line parallels the columns, which run North and South, and has "T" outlets at 10-foot intervals. Because the centers of the bays are aisles, air will never be more than 25 feet away from any production point in production areas.

Operations on the electrode manufacturing side require little air. We decided to bring air lines down only those columns where needed.

In planning air capacity, we decided, for obvious reasons, to use a 220-cfm compressor from our old plant. It was fairly new and in good operating condition. Analysis showed that we would need another 300 to 500 cfm for normal operations. Final decision was to install two 550-cfm compressors in addition to the old unit. With three units, we would have sufficient operating and standby capacity plus considerable flexibility. During normal operation the 220-cfm unit and one 550-cfm unit could carry the load. Second 550-cfm unit is kept as emergency standby. On weekends and during other partial overtime periods, the 220-cfm unit alone is sufficient. During unusual peak periods we can operate both 550-cfm units.

Small, old unit is a 2-stage, rotary-type compressor. Two larger units are 2-stage, V-type compressors. System pressure is maintained at 100 psig.

Plant is designed with boilerhouse centrally located on the North side. Air compressors are in this boilerhouse. From here, a welded 6-inch line carries air to a 4-foot diameter by 16-foot high cylindrical outdoor storage tank.

air distribution goes underground

Compressed air is piped just below the roof trusses for about 300 feet to the building center. It is then dropped down to the center of an underground service corridor. This service corridor is another unusual feature. It is 20 feet wide, centrally located, and runs the entire length of the building. Corridor provides an ideal passageway for utility lines — electricity, gas, water, and air — in addition to providing access to locker, service, and toilet rooms.

Compressed air is brought to the center of the service corridor. From here it goes both east and west for about 700 feet, just below the plant floor. Pipe from the storage tank to both ends of the service corridor is 4-inch welded line.

Every 60 feet in the corridor there is a floor opening through which utility services go into the plant. Compressed-air lines at these points are 1½-inch diameter. They rise to about 12 feet above the plant floor where they reduce to 1-inch diameter, then go north and south. Air is conveniently available in every production area in this plant.

One of two Joy Manufacturing Company's 550-cfm, 2-stage compressors that satisfy air system demands.

An isolating shutoff valve is installed where the air line from the boiler room enters the center of the corridor. Pressure can be cut off independently to either side of the plant. There are also shutoff valves where each 1½-inch line is taken from the main, and where each of these lines is reduced to 1-inch diameter.

compressed air does many jobs

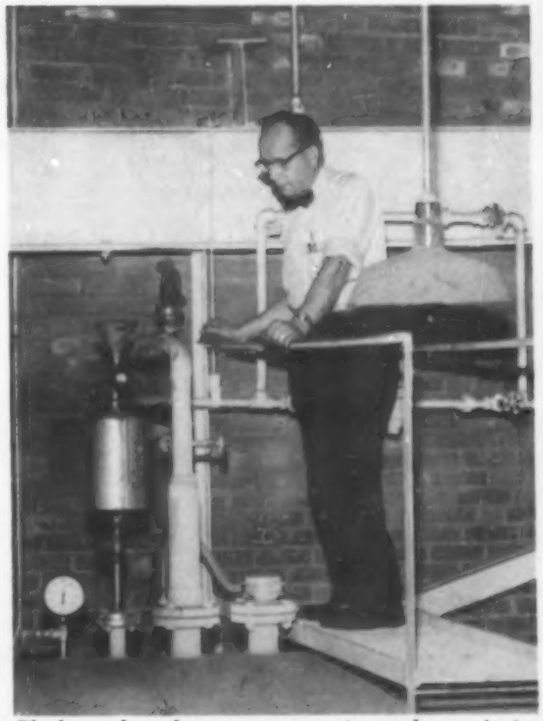
We are regularly using at least 250 air outlets in direct manufacturing operations. These include approximately 75 outlets for machining operations — such as air-operated jigs and fixtures, air clutches on punch presses, clamping, and tooling devices. Another 125 outlets are used for air hand tools. These include chipping hammers, nut runners, air screwdrivers, and air-operated paint stirrers. Another 50 outlets are in use for blow-off and chip removers. Air-operated pick-off devices and transfer units are used on conveyor lines.

Along the north and south plant walls, 18 loading and unloading truck platforms are equipped with air-operated ramps to accommodate different height trucks. Receiving platform extends the entire quarter-mile length of the plant's north side. Shipping dock extends the entire length of the south side. Incoming materials and components are taken immediately to machines or assembly areas. There is no central stockroom or storage space. Operations simply move from north to south in their own particular area. Air-operated truck ramps are stategically located along the receiving and shipping docks to facilitate this plan. Truck and freight car unloading and loading is done entirely inside the plant. Compressed air for operating truck ramps is piped directly from the main line in the service corridor. Piping is imbedded in the concrete floor.

separate air system controls heating

Approximately 25 heating units in the plant and offices are all automatically controlled by air motors. Compressed air for these units is provided by a completely independent system consisting of a separate 12.1-cfm compressor. This air is carried under the plant roof trusses in ¼- to ¾-inch copper tubing.

(continues on page 25)



Platform above hot-water expansion tank permits inspection of safety valve and heating system controls.

Because your askarel
is more easily contaminated
than your transformer oil, you'll want to know how to

TEST YOUR transformer *ASKAREL*

S. L. FOSTER
Allis-Chalmers Manufacturing Company
with Donald Hartley, Managing Editor

BECAUSE ASKAREL PROTECTS big investments in transformer dollars and electrical capability, regular askarel checkups pay off.

Askarel must be checked periodically to determine its electrical properties. Testing frequency depends somewhat upon loading and possibility of contamination, but usually tests are made annually or semiannually. Contamination is easy and dielectric properties change with age.

Although askarel has properties similar to oil regarding cooling and dielectric strength, it is nonflamable, heavier, and more easily contaminated because of its greater solvency. General properties of transformer askarel—sold under several trade names such as Chlorextol, Inerteen, and Pyranol—are shown in Table I.

Once transformers are in service, not all properties of askarel need be checked to determine suitability for continued use. Usual tests to determine askarel condition are:

- Dielectric strength
- Resistivity
- Acidity
- Corrosive chloride concentration

Dielectric strength can be tested without laboratory equipment. Tests for resistivity, acidity, and corrosive chlorides require simple laboratory equipment, however, plus some special equipment.

how to take a sample

Take considerable care to prevent contamination before testing. Care in handling is required because askarel irritates skin. Askarel being sampled must be at or above room temperature (25 C). Askarel below 20 C must be heated above 20 C before sampling. Samples should not be taken when relative humidity exceeds 75 percent. Sampling container must be clean and dry. A 1-quart glass bottle

Sampling device is just below liquid level. Turn handle just enough to withdraw sample from surface.

TABLE I — PROPERTIES OF TRANSFORMER ASKAREL

Test	New	Minimum for Service*
Viscosity @ 37.8 C	54 seconds	
Specific gravity @ 15.5 C	156	
Color alpha	150 max.	300
Acidity	0.01 max.	0.05
Pour point (ASTM D 97)	-32 C	-32 C
Inorganic chlorides	0.10 ppm max.	5
Corrosion	After heating with aluminum for six hours at 200 to 220 C, aluminum must not be corroded by visual inspection or by weight, and askarel should meet these specifications: Color: 200 max. Acidity: 0.01 max.	Same
Water content	30 ppm max.	100 max.
Resistivity @ 100C, 500 volts/0.1 in.	100 x 10^9 ohm cm.	100 x 10^7 ohm cm.
Dielectric strength @ 25 C	35 kv/0.1 in.	20 kv/0.1 in.

*Once askarel is in service, it need not be tested for all physical properties.

Resistivity test determines contamination. All equipment must be clean and dry.

with a glass or phenolic stopper is best. No rubber or similar compound must be used to seal it. If the stopper does not fit tightly, wrap aluminum foil around it to make a tight fit.

always sample from top

Askarel samples are always taken from top of the transformer because askarel's high specific gravity causes any moisture and moisture-laden contaminants to float. Sampling device usually is located near the top of the unit. Usually, it is a 90-degree bent tube passing through the tank wall just below the upper liquid level. A cap on the outer end prevents leakage and keeps the tube end clean for sampling. When tube inside tank is vertical upward and handle outside is vertical downward, the open end inside is above the liquid. Tube can be turned by the handle. Tube should be turned just enough to get a sample, so that sample will be from the upper surface. If the device has a ball check, hold the ball open with a clean steel rod that has been heated to drive off any moisture, and withdraw sample.

Draw off enough liquid to flush out tube, steel rod, bottle, and stopper. Then discard this flushing liquid and take sample. To prevent contamination, hands must not touch either the liquid or test container parts that contact the liquid.

If no provision is made for sampling, remove a handhole cover or plug and take sample from the top of the liquid. If a thief is used, position glass tube so that air bubbles are drawn in with the sample. This insures that sample comes from the liquid surface. If sample is to be kept for any length of time, store it in brown glass bottles or clear glass bottles in light-proof boxes.

Much of the same equipment used for testing insulating oil may be used, but it must be thoroughly cleaned before using for askarel tests. Test equipment can be cleaned by washing with oil and lead-free gasoline, then with strong soap or trisodium phosphate solution. After washing, rinse equipment with tap water and then rinse thoroughly with distilled water. Dry all parts for two hours in a 110 C oven after washing. Stopper sample bottles and keep in a dry, dustfree place until used. Test equipment should be used within 8 hours of cleaning.

dielectric test is simple

Testing for dielectric strength is easy and does not require a laboratory. Same equipment used for dielectric testing of oil can be used. This test checks dielectric breakdown between two electrodes placed .01 in. apart in the liquid. Electrodes are circular, 1 inch in diameter, and square edged. They are placed in a cup that holds about ¼-pint of liquid. Some sets have electrodes permanently mounted the standard 0.1 inch apart, others provide adjustment for this dimension. Check the adjustable electrode spacing with 0.1-inch diameter rod.

Cup must be of phenolic material for testing askarel. A hard rubber cup is not suitable. Cup and electrodes must be thoroughly cleaned and dried before starting test. Rinse cup three times before filling for test. Allow askarel liquid to stand in the cup 3 minutes before testing. Three tests should be made, each with a fresh sample. If test results are nearly the same, record the average as the dielectric strength. If they vary widely, take another sample and take more care to prevent contamination.

Dielectric strength is an indication of moisture content and contamination due to organic insulation deterioration. If a low dielectric strength is shown, test for resistivity and acidity to determine the type and amount of contamination present. Table I includes typical service values for dielectric strength test. This is not as good an overall test for quality of askarel as it is for quality of oil, however. Resistivity test gives a better indication for askarel.

how to test for resistivity

Resistivity is tested with two concentric nickel cylinders placed 0.1 inch apart. A pyrex glass plate with scribed concentric circles helps place the cylinders exactly concentric. Clean electrodes, glass marking plate, 800-ml beaker, and thermometer ac-

(continues on page 30)

Keep these handy charts nearby. U. S. Navy, constantly trying to save taxpayers' money, has developed these charts that will save time when next you want a

QUICK estimate for your power plant *COSTS*

JOHN W. BISHOP
Mechanical Engineer
Power Generating Section
Bureau of Yards and Docks
U. S. Navy Department,
with Donald Hartley, Managing Editor

WHEN YOU WANT COSTS in a hurry for a complete boiler plant or steam electric power plant, try this quick, graphic method. It gives average costs for typical, economically designed plants of the type you may require.

Two 4-quadrant graphs are used. Fig. 1, for boiler plant costs, considers plant steam capacity, type of fuel, operating pressure, steam temperature (shown as degrees of superheat), and a location factor to adjust 1957 construction costs for your particular locale. Fig. 2, for power plant costs, considers electric capacity, throttle pressure, throttle temperature, type of turbines (noncondensing, straight condensing, extracting-condensing), and location factor. Costs derived from Fig. 1 are for a two-boiler plant, expandable to three boilers. Fig. 2 costs are for a two-turbogenerator plant, expandable to three turbogenerators (excluding boiler plant cost).

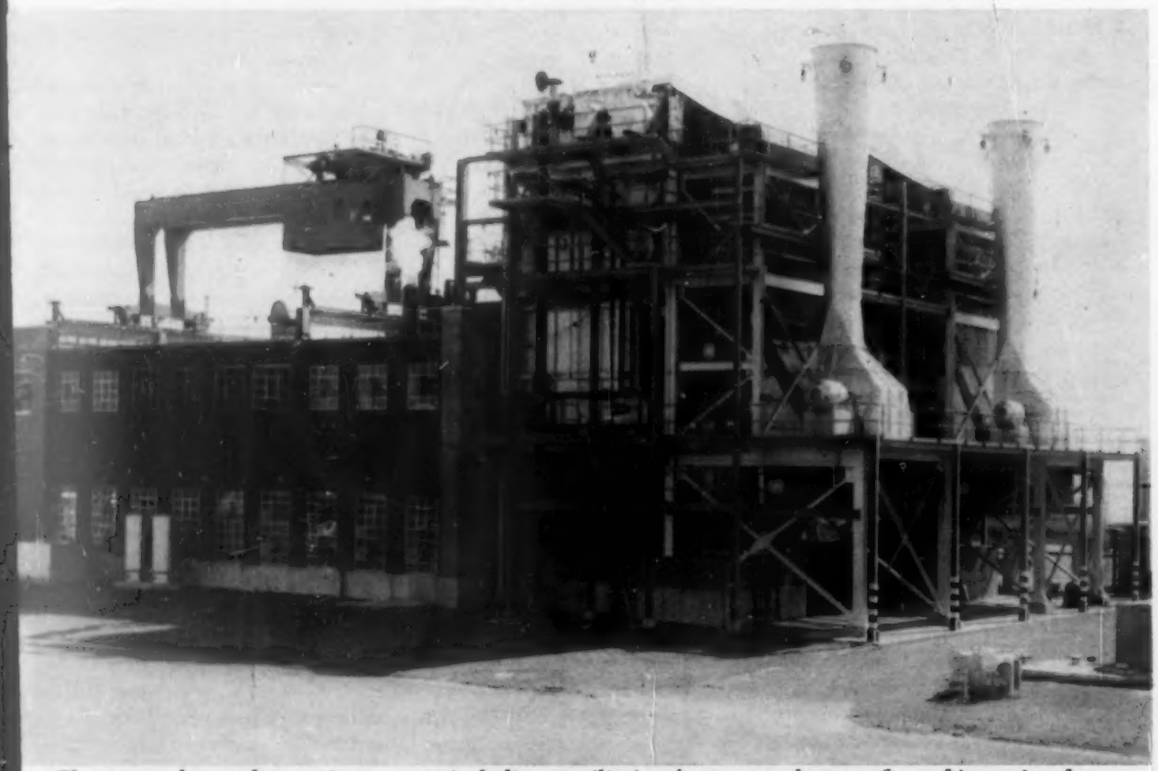
Only Fig. 1 need be used in making the cost estimate for a plant generating just steam. Where electric generation is to be installed, also, cost derived from Fig. 2 is added to cost of boiler plant used to supply the turbine plant.

Costs include labor and materials plus contractors' overhead and profit. Location factors are subject to change from year to year, but for 1957 the figures in Table 1 are suggested. Construction costs for plants, outside the immediate vicinity of locations shown, must be adjusted with respect to cost of freight and labor.

EXAMPLE: A central heating plant is required 10 miles from Columbus, Ohio to fire coal and oil and to supply 120,000 lb/hr saturated steam at 125 psig. From location factor table, the location factor equals 1.00. Following the solid red line on Fig. 1, the estimated cost of $650,000 is found.

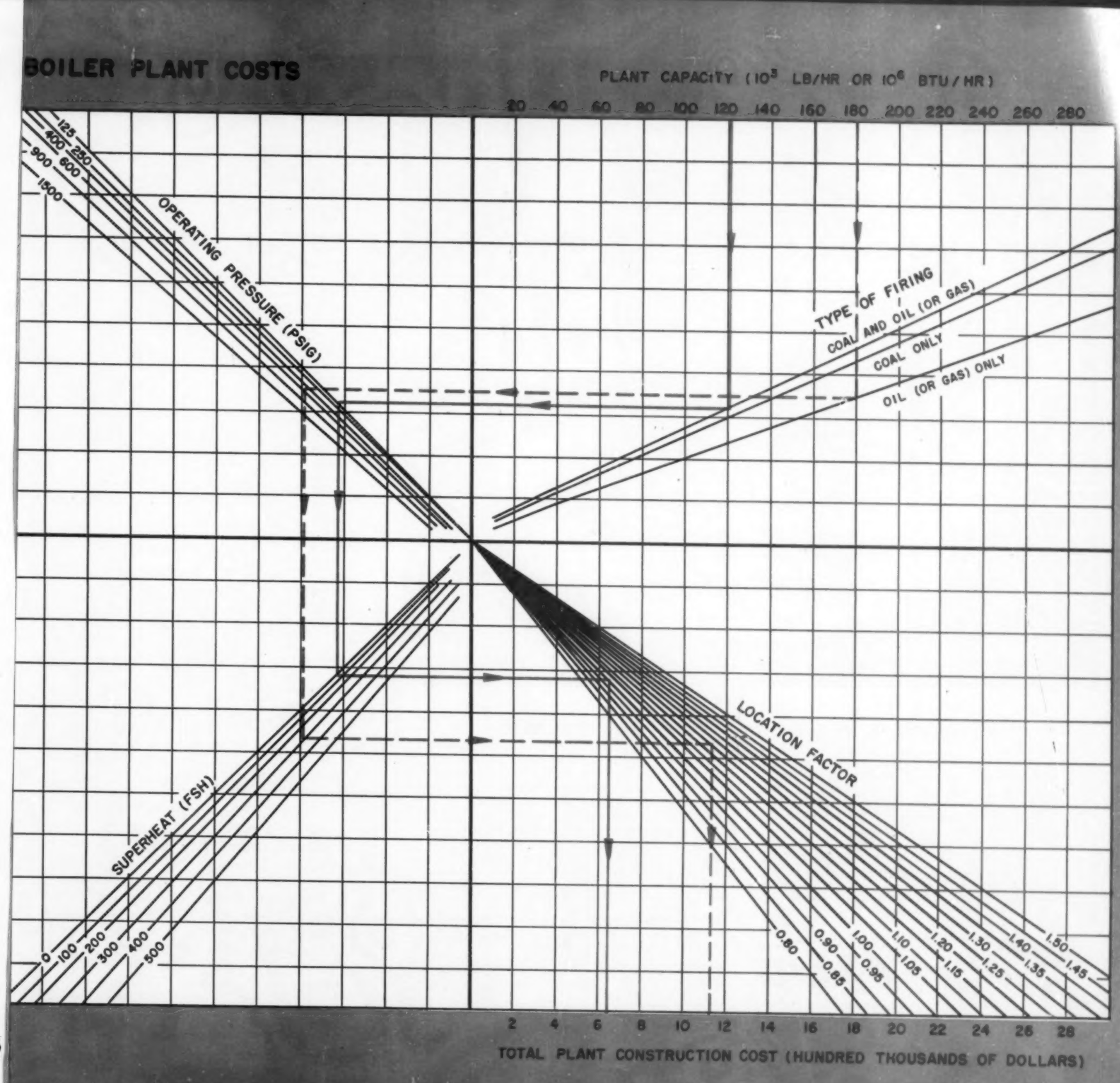
EXAMPLE: A power plant boiler room is required some distance from Seattle, Wash. From the location factor table, location factor of 1.2 is derived. Two oil-fired boilers will be needed to supply 180,000 lb/hr steam at 600 psig and 750 F (261 F superheat).

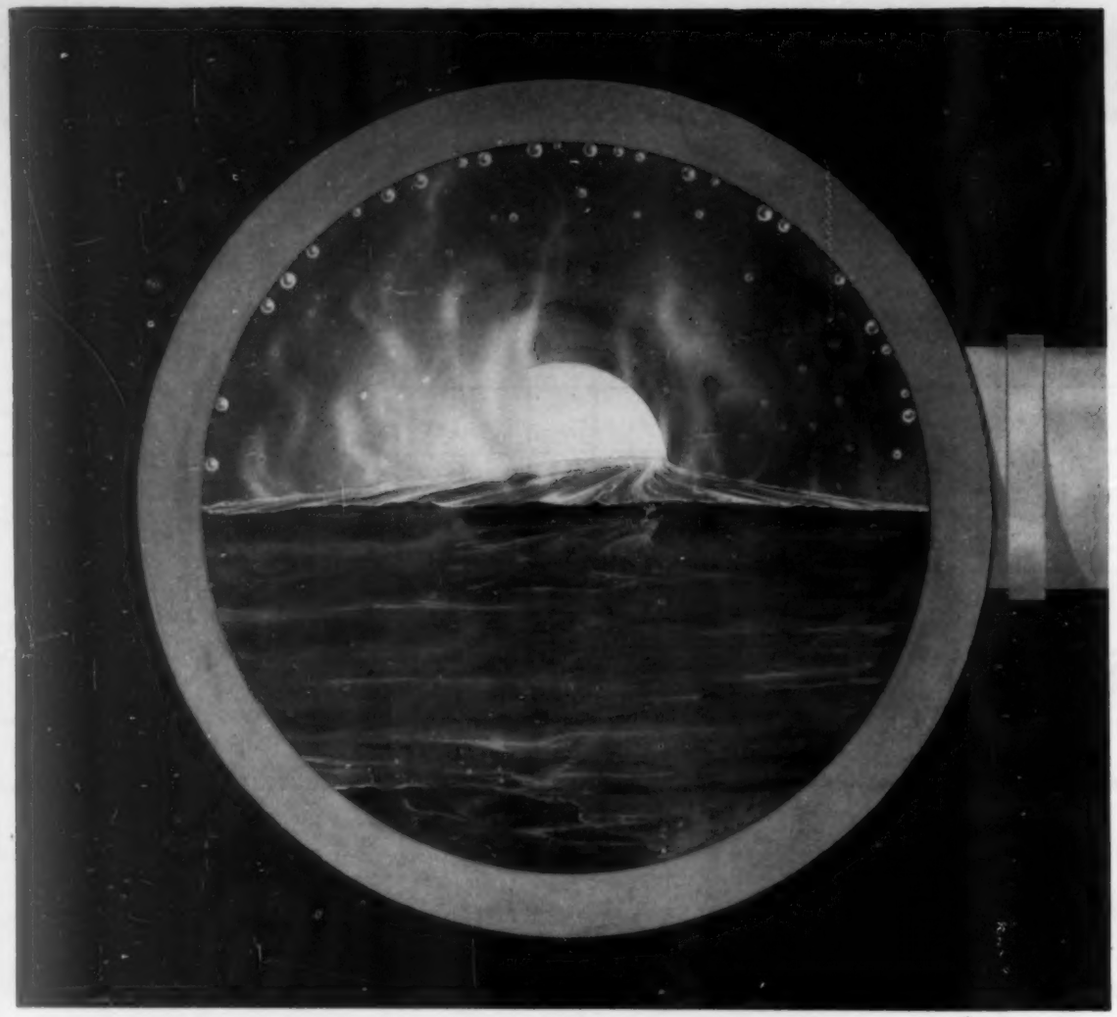
(continues on page 20)



Charts can be used to estimate cost, including auxiliaries, for power plants such as this semioutdoor one.

Fig. 1 — For cost of steam generating plant, find location factor and follow direction of colored lines.


BOILER PLANT COSTS
PLANT CAPACITY (10^3 LB/HR OR 10^6 BTU/HR)
20 40 60 80 100 120 140 160 180 200 220 240 260 280
OPERATING PRESSURE (PSIG)
125
400 250
900 600
1500
TYPE OF FIRING
COAL AND OIL (OR GAS)
COAL ONLY
OIL (OR GAS) ONLY
LOCATION FACTOR
0.80
0.85
0.90
0.95
1.00
1.05
1.10
1.15
1.20
1.25
1.30
1.35
1.40
1.45
1.50
SUPERHEAT (FSH)
0
100
200
300
400
500
2 4 6 8 10 12 14 16 18 20 22 24 26 28
TOTAL PLANT CONSTRUCTION COST (HUNDRED THOUSANDS OF DOLLARS)



WHAT'S A MONOMOLECULAR FILM?

It is a film one molecule thick. Filmeen* in steam or condensate lines produces a monomolecular film.

But, there's a lot more to it than thickness. The film's most important function is protection against corrosion. By forming a nonwettable coating on all metal surfaces with which treated steam or condensate come in contact, Filmeen provides a protective, corrosion-inhibiting barrier between water and metal. In heat exchange equipment, the condensed steam treated with Filmeen then forms as spherical drops of water which resist adherence to the film surface, much the same as a drop of water will form into a small ball on a waxed surface. This phenomenon results in increased rate of heat transfer—which in turn saves money in power plant operation.

When steam condenses on untreated return lines, it forms a continuous layer of water that restricts heat transfer. You don't want that... it raises the cost of heat.

Your Dearborn sales engineer will gladly explain how Filmeen can keep your heating costs in line.

*Filmeen is the trade-mark of a corrosion-inhibiting compound produced exclusively by Dearborn Chemical Co. U.S. Pat. No. RE 23614.

Dearborn®

a leader in water conditioning and corrosion control

Dearborn Chemical Company
Dept. INP Merchandise Mart Plaza, Chicago 54, Ill.

Please send me complete information about Filmeen.

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

Circle 106 on READ-N-CIRCLE card for more data

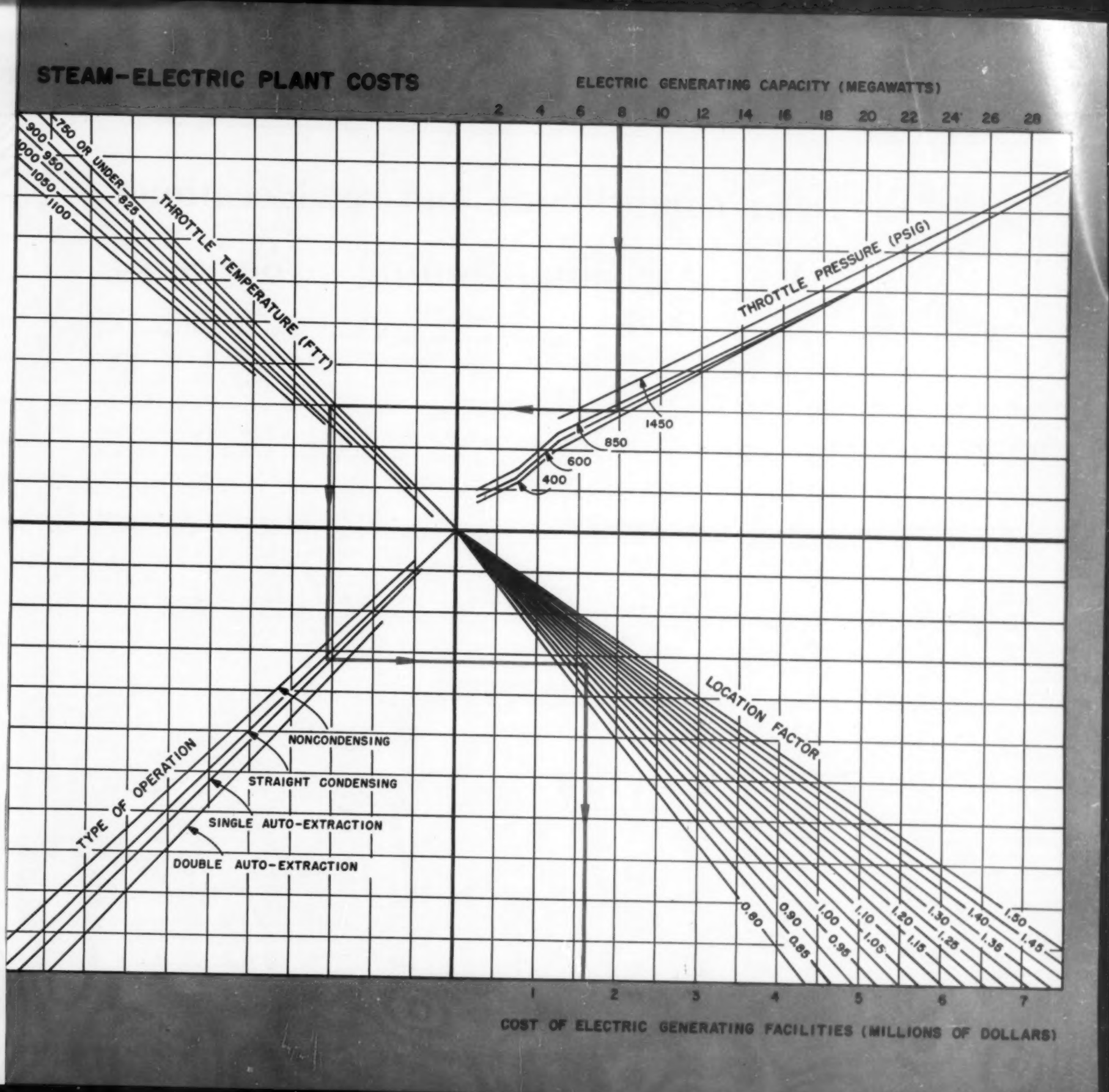
TABLE 1 — LOCATION FACTORS FOR 1957

Area	Location Factor
Albany, Schenectady, Troy, N. Y.	1.03
Albuquerque, N. M.	1.12
Atlanta, Ga.	0.97
Baltimore, Md.	0.98
Birmingham, Ala.	0.95
Boston, Mass.	1.08
Buffalo, N. Y.	1.04
Chicago, Ill.	1.06
Cincinnati, Ohio	1.02
Cleveland, Ohio	1.08
Columbus, Ohio	0.99
Dallas, Texas	1.08
Denver, Colo.	1.12
Des Moines, Iowa	1.08
Detroit, Mich.	1.09
El Paso, Texas	1.07
Houston, Texas	1.06
Indianapolis, Ind.	1.02
Jackson, Miss.	0.97
Jacksonville, Fla.	0.96
Kansas City, Mo.	1.05
Los Angeles, Calif.	1.11
Memphis, Tenn.	0.96
Miami, Fla.	1.05
Milwaukee, Wis.	1.01
Newark, Elizabeth, Jersey City, N. J.	1.15
New Haven, Conn.	1.07
New Orleans, La.	1.01
New York City, N. Y.	1.14
Norfolk, Va.	0.98
Omaha, Nebr.	1.07
Philadelphia, Pa.	1.02
Phoenix, Ariz.	1.13
Pittsburgh, Pa.	1.02
Rochester, N. Y.	1.06
Rock Island, Moline, Ill.	1.02
St. Louis, Mo.	1.08
Salt Lake City, Utah	1.11
San Antonio, Texas	1.02
San Francisco, Calif.	1.14
Savannah, Ga.	0.96
Seattle, Wash.	1.15
Spokane, Wash.	1.14
Springfield, Ill.	1.03
Tulsa, Okla.	1.06
Washington, D. C.	1.04

By following the dashed red line on Fig. 1, estimated cost of $1,140,000 is found.

EXAMPLE: A generating station with 8000 kw capacity is to be built outside Baltimore, Md. Steam will be provided to a single auto-extration turbine at 600 psig and 825 F throttle. From table, location factor equals 1.00. By following the dotted red line on Fig. 2, an estimated cost of $1,650,000 is found. Note that this figure does not include boiler plant cost, which must be determined from Fig. 1.

Fig. 2—Note that chart does not include cost of steam generation facilities, merely electric generation.


STEAM-ELECTRIC PLANT COSTS
ELECTRIC GENERATING CAPACITY (MEGAWATTS)
2 4 6 8 10 12 14 16 18 20 22 24 26 28
750 OR UNDER
825
900
950
1000
1050
1100
THROTTLE TEMPERATURE (FTT)
THROTTLE PRESSURE (PSIG)
1450
850
600
400
TYPE OF OPERATION
NONCONDENSING
STRAIGHT CONDENSING
SINGLE AUTO-EXTRACTION
DOUBLE AUTO-EXTRACTION
LOCATION FACTOR
0.80
0.85
0.90
0.95
1.00
1.05
1.10
1.15
1.20
1.25
1.30
1.35
1.40
1.45
1.50
1 2 3 4 5 6 7
COST OF ELECTRIC GENERATING FACILITIES (MILLIONS OF DOLLARS)

Air conditioning and refrigeration

V - - Air conditioning processes

JOHN F. LEE
Professor of Mechanical Engineering
North Carolina State College
with Donald Hartley, Managing Editor

Here are some of the principles behind your day-to-day air conditioning and refrigeration problems. Each article in IP's POWER BASICS covers some facet of air conditioning or refrigeration that will help you do your job better. Each one can be read without reference to the others and without any loss of continuity. Single sets of the complete series are available without charge. Send in your request now. Quantity prices on request.

NO MATTER HOW COMPLEX an air conditioning system may be, it can be broken down into basic processes to permit a straight-forward analysis. A knowledge of the simpler processes is useful, because it simplifies the most complicated problems.

A humidification process is simply one that increases specific humidity of the air. An increase in humidity does not necessarily imply an increase in relative humidity. It is possible to increase specific humidity and actually decrease relative humidity. Two types of humidification processes will be considered—*humidification with air cooling*, and *humidification with air heating*.

Humidification with air cooling can be achieved by adiabatic evaporative cooling, as shown in Fig. 1. A large quantity of water is constantly circulated through a spray chamber. The air and vapor mixture is passed through the spray. This evaporates some circulating water. Air may leave in a saturated state or at some particular specific humidity, depending on the controls employed. In any event, increase in specific humidity equals quantity of circulating water evaporated per unit mass of dry air passed through the chamber. No heat transfer takes place between the chamber and its surroundings. Energy required for evaporation, therefore, is supplied by the air and the dry-bulb temperature is lowered as a result. After the process has been in operation for a sufficient time, the circulating water approaches the thermodynamic wet-bulb temperature. We have seen that this differs slightly from the ordinary wet-bulb temperature. After this equilibrium temperature is reached, the process proceeds at very nearly constant wet-bulb temperature, as indicated in Fig. 1. An extremely small portion of the circulating water must be replenished to make up for evaporation losses. Hence, the fact that the temperature of the makeup water may differ from the equilibrium or wet-bulb temperature has a negligible effect.

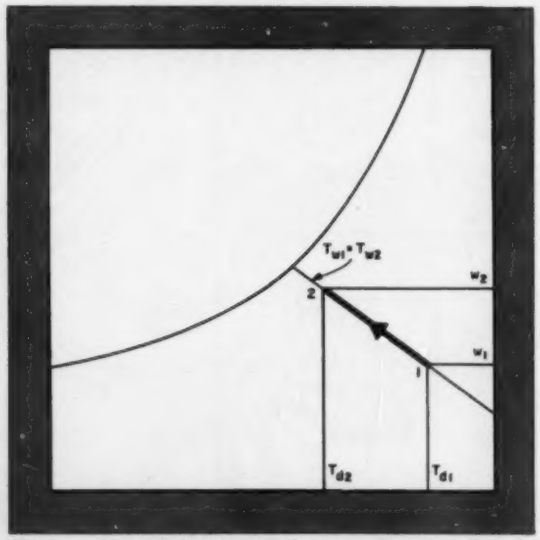


Fig. 1 — Humidification with air cooling can be obtained by passing air and vapor through water spray.

A common process for humidification and heating occurs in a conventional warm-air furnace fitted with a humidifier. This may be a spray type, but is more usually an open pan of water. After air has been heated by the furnace, it passes through the humidifier. Process is illustrated in Fig. 2. Note that specific humidity has increased and relative humidity has decreased. If it is assumed that $h_{f1} = h_{f2}$, Eq. (10) in Part IV of this series may be written as

$$h_2 = h_1 + h_f (m_2 - m_1) - q \qquad (1)$$

since $w_{t1} - w_{t2} = m_2 - m$,

EXAMPLE: If atmospheric air at a dry-bulb temperature of 85 F and at relative humidity of 60 percent enters a humidifier at 2000 cu ft/hr and emerges at 75 F dry-bulb temperature, what is (a) specific humidity and (b) relative humidity of air leaving the humidifier if process is one of evaporative cooling? (c) What is quantity of water evaporated per hour? Atmospheric pressure is 14.7 psia.

SOLUTION: If conditions entering and leaving huimifier are designated by subscripts 1 and 2 respectively, we find from the psychrometric chart that

$w_1 = 109$ gr/lb dry air
$p_v = 0.36$ psia

(a) At the intersection on the psychrometric chart of constant wet-bulb temperature line for 74 F and constant dry-bulb temperature line for 75 F, we find that

$w_2 = 125$ gr/lb dry air

and (b)

$RH_2 = 95$ percent

(c) Vapor pressure of atmosphere entering the humidifier is 0.36 psia so that the partial pressure of the dry air is

$$p_a = p_m - p_v = 14.7 - 0.36 \text{ psia}$$
$$= 14.34 \text{ psia}$$

Hence, mass rate of flow of dry air is

$$M_a = \frac{p_a V}{RT} = \frac{14.34 \text{ psi} \times 144 \times 2000}{53.35 \times 545}$$
$$= 142 \text{ lb/hr}$$

Since there are 7000 grains in a pound, water evaporated is

$$M_f = M_a \ (w_2 - w_1)$$
$$M_f = \frac{142 \ (125 - 109)}{7000}$$
$$= 0.33 \text{ lb/hr}$$

Although water vapor may be removed from air by chemical and physical means, we shall only consider cooling process below the dew point here. This process is particularly interesting because it also involves simple cooling and simple heating of the air and vapor mixture. Dehumidification process is shown in Fig. 3. A mixture of air and water vapor at state 1 is cooled at constant specific humidity (over cooling coils) to the dew-point temperature at 1'. Continued cooling causes some vapor to condense until some desired dew-point temperature at 2' (or some specific humidity) is reached. Condensed vapor is then removed from mixture. From 2' to 2, the remaining air and vapor mixture is heated by heating coils at constant specific humidity to the original dry-bulb temperature. If desired, the final dry-bulb temperature may be different from the original one.

For this process, noting that

$w_{f1} = 0$ and $w_{f2'} = w_1 - w_2$,

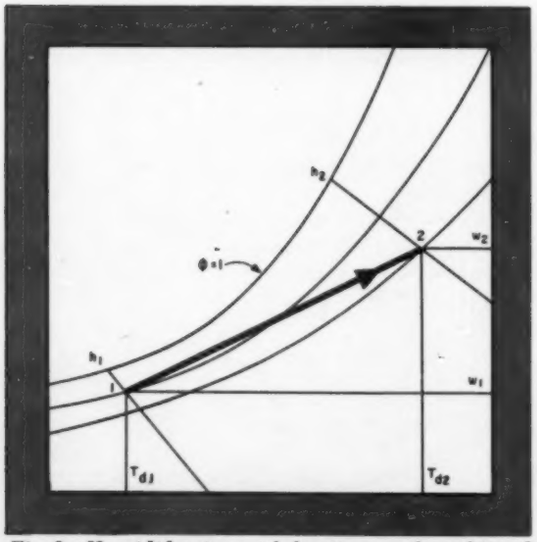


Fig. 2—Humidification with heating can be achieved by passing hot air and vapor over evaporating water.

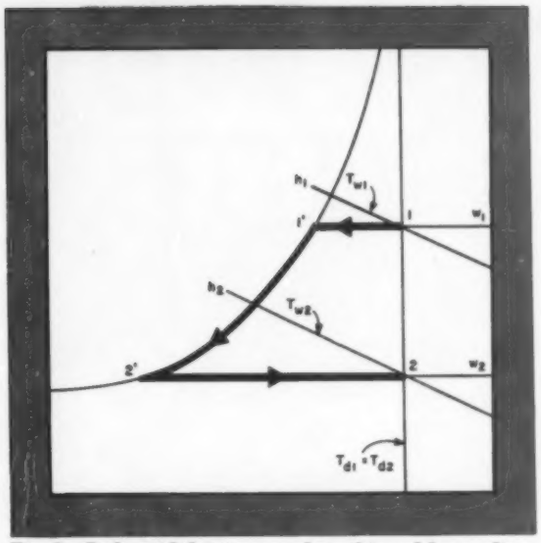


Fig. 3—Dehumidification can be achieved by cooling mixture below dew point, removing water, heating.

Eq. (1) may be written as

$$h_1 - h_{2'} = q + (w_1 - w_2) \ h_{f2'}$$

Note that q is the net heat transfer in the process from 1 to 2. Heat transferred from the system in the cooling process from 1 to 2' and heat transferred back into the system from 2' to 2 is more significant, however. This equation, accordingly, may be written in two steps to give the heat transferred for cooling and heating individually:

$$q_{1\text{-}2'} = h_1 - h_{2'} - (w_1 - w_2) \ h_{f2'} \quad \text{(cooling)} \quad (2)$$
$$q_{2'\text{-}2} = h_2 - h_{2'} \quad \text{(heating)} \quad (3)$$

EXAMPLE: Air leaves a dehumidifier at a dry-bulb temperature of 70 F and at relative humidity of 50 percent. If air enters the dehumidifier at a dry-bulb temperature and relative humidity of 90 F and 60 percent, respectively, find (a) amount of cooling required and (b) quantity of heat supplied to coil.

SOLUTION: (a) Dehumidification process is outlined in Fig. 3. From the psychrometric chart we find that

$w_1 = 128$ gr/lb dry air
$h_1 = 41.6$ Btu/lb dry air
$h_2 = 25.2$ Btu/lb dry air
$h_{2'} = 19.8$ Btu/lb dry air
$w_2 = 56$ gr/lb dry air

From steam tables, entering with a wet-bulb temperature of 49 F corresponding to point 2', we get

$h_{f2'} = 17.07$ Btu/lb water

Cooling required per pound of dry air is obtained from Eq. (2) as

$$q_{1\text{-}2'} = h_1 - h_{2'} - (w_1 - w_2) \ h_{f2'}$$
$$= (41.6 - 19.8) - \frac{17.07 \ (128 - 56)}{7000}$$
$$= 21.6 \text{ Btu/lb dry air}$$

(continues on page 24)

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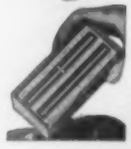

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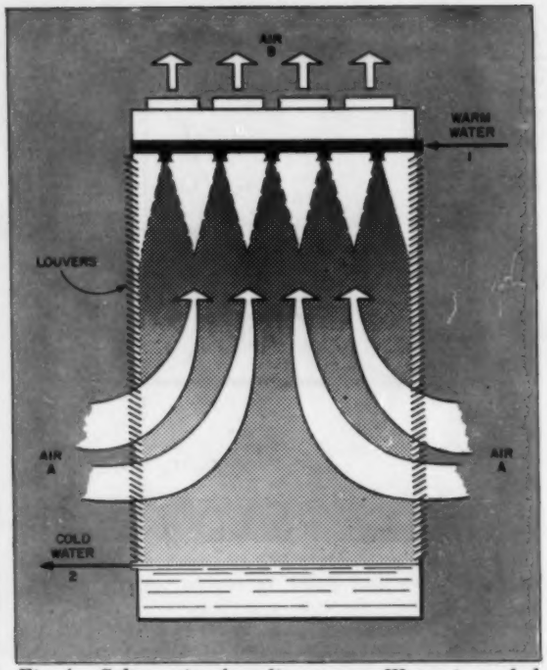

Fig. 4—Schematic of cooling tower. Water is cooled below dry-bulb temperature by evaporative cooling.

(b) Heat supplied to heating coil is found from Eq. (3) as

$$q_{2'\text{-}2} = h_2 - h_{2'}$$
$$= 25.2 \text{ Btu/lb} - 19.8 \text{ Btu/lb}$$
$$= 5.4 \text{ Btu/lb dry air}$$

We have already seen that evaporative cooling can be used to humidify and cool air. We saw earlier that the circulating water can be cooled only to the wet-bulb temperature. Cooling towers utilize the phenomenon of evaporative cooling to cool warm water below the dry-bulb temperature of the air. The water never reaches the wet-bulb temperature, however, because an excessively large cooling tower would be required. Also, since warm water is continuously introduced to the tower, equilibrium conditions obtained in the previously described evaporative cooling process are not achieved, and the dry-bulb air temperature is increased. While the water is cooled, therefore, the air is heated and humidified.

Fig. 4 shows schematic arrangement of a cooling tower. Warm water is introduced at the tower top and is sprayed down over baffles that assist in presenting a large surface for evaporation by keeping the water in small droplets or thin sheets. Atmospheric air circulates up through the water and leaves at the top very nearly saturated. Energy equation is more useful than psychrometric charts for solving cooling-tower problems because charts do not present a sufficient range of properties. It may be necessary to compute the properties. Noting that no heat transfer takes place between the system and surroundings, we have

$$h_{aA} + w_A\, h_{vA} + w_{f_1}\, h_{f_1} = h_{aB} + w_B\, h_B + w_{f_2}\, h_{f_2} \qquad (4)$$

and

$$w_{f_1} - w_{f_2} = w_A - w_B$$

EXAMPLE: A cooling tower cools 300,000 lb/hr of water from 120 F to 80 F. Air enters cooling tower with a dry-bulb temperature of 70 F and a wet-bulb temperature of 60 F and leaves as a saturated mixture with a dry-bulb temperature of 110 F. Determine (a) mass flow of atmospheric air required, and (b) rate at which water is evaporated.

SOLUTION: Refer to Fig. 4. Assuming a standard atmospheric pressure of 14.7 psia, vapor pressure of air entering the tower is

$$p_{va} = p_w - \frac{(p - p_w)\,(T_d - T_w)}{2800 - 1.3\,T_w}$$

where T_w = wet-bulb temperature
T_d = dry-bulb temperature
p_w = vapor pressure corresponding to T_w
p = total pressure

$$P_{vA} = 0.2563 - \frac{(14.7 - 0.2563)\,(70 - 60)}{2800 - (1.3 \times 60)}$$
$$= 0.2032 \text{ psia}$$

Since air leaving cooling tower is saturated, vapor pressure is obtained directly from steam tables for a dry-bulb temperature of 110 F.

$$P_{vB} = 1.2748 \text{ psia}$$

Specific humidity of entering air is

$$w_A = 0.622 \times \frac{0.2032}{(14.7 - 0.2032)} = 0.0087$$

and for leaving air, it is

$$w_B = 0.622 \times \frac{1.2748}{(14.7 - 1.2748)} = 0.059$$

Enthalpy of vapor in entering air is, from steam tables,

$$h_{vA} = 1092.3 \text{ Btu/lb}$$

and for leaving air it is

$$h_{vB} = 1109.5 \text{ Btu/lb}$$

Enthalpies of water entering and leaving tower are, from steam tables,

$$h_{f_1} = 87.92 \text{ Btu/lb}$$
$$h_{f_2} = 48.02 \text{ Btu/lb}$$

From the energy balance, mass of water per unit of dry air is

$$w_{f_1} - w_{f_2} = w_B - w_A = (0.059 - 0.0087)$$
$$= 0.0503 \text{ lb water/lb dry air}$$

Mass flow of air (including vapor) entering tower is

$$M_a = \frac{300{,}000}{1.1} + 0.0087$$
$$\frac{300{,}000}{1.1} \times 0.0087 \left(\frac{300{,}000}{1.1}\right)$$
$$= 275{,}000 \text{ lb/hr air}$$

Rate of water evaporation is

$$M_w = 0.0503 \times \frac{300{,}000}{1.1}$$
$$= 13{,}700 \text{ lb/hr water} \quad ♦ ♦$$

Editor's Note: This concludes the present series on air conditioning and refrigeration.

Lincoln doubles air capacity

. . . starts on page 14

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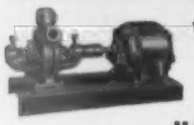

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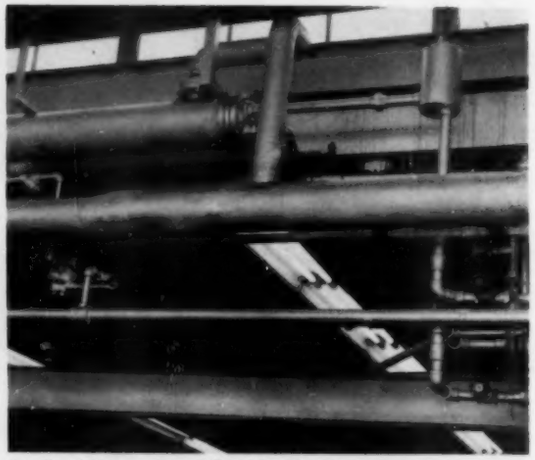
Packaged for expansion

. . . starts on page 12

of the plant. Each heat-exchanger station includes a column-mounted thermostat and a ½-hp hot water pump. Steam and hot water circuits are independently controlled. The only equipment common to both is the heat exchangers.

Twelve-inch pipeline from the boilerhouse splits into one 8-inch and one 6-inch pipeline to supply the heat exchangers. Each heat exchanger is a cylindrical double-shell type about 4-feet long. Steam passes through the outer shell, transfers heat to the radiant-heating system water, condenses, and is pumped back to the boiler. Dual condensate return pump handles the entire condensate return for



Each of 23 overhead double-shell heat exchangers has its own thermostat control and ½-hp hot water pump.

all 23 heat exchangers. Exchangers are on the steam circuit continuously. Space heating is effected entirely by hot water circulation.

Temperature of each plant area may be individually adjusted. When temperature drops below preset level, thermostat starts the circulating water pump. When temperature rises to preset level, the thermostat stops the pump. Hand valve, set to supply 90 F water on continuous circulation, is on the steam line to each heat exchanger. When circulation stops, water temperature rises in heat exchanger. Water is maintained under 80 psig pressure and does not vaporize under temperatures encountered so far.

Steam leaves boiler outlets at 10 psig, and drops to around 5 psig at heat exchangers. Very light load may allow exchanger pressure to build up close to boiler pressure. This is not ordinary.

Our troublefree heating system has been in operation for 8 years, 8 months out of every year. Heat-exchanger stations and radiant-heating grids were designed by C. W. Colby, consulting engineer. J. O. Barkwell, Grand Rapids, was the building architect. Stellingworth and Feely, Grand Rapids, installed all four package steam generators.

all steam for space heating

During the heating season, the plant is operated 24 hours a day except on weekends. We do not require any steam for process or miscellaneous use. We consume around 80,000 gal/yr of fuel oil. Our underground storage capacity is 40,000 gallons.

The two 100-hp generators are operated in the fall and spring. The two 125-hp units are operated in winter, with the 100-hp units available for standby. Boilers are hooked up in pairs of matching units, arranged to allow the second boiler to act as a booster. First boiler is set to cut in at 6 psig and out at 10 psig. Second boiler is set to cut in at 4 psig and out at 8 psig. If the first boiler cannot maintain the pressure, the second starts up automatically. It operates until its pressure cut-out point has been reached. If load is fairly steady and is within the two-boiler capacity range, the boilers are kept on modulated firing control. All controls operate automatically as regulated by pressure change.

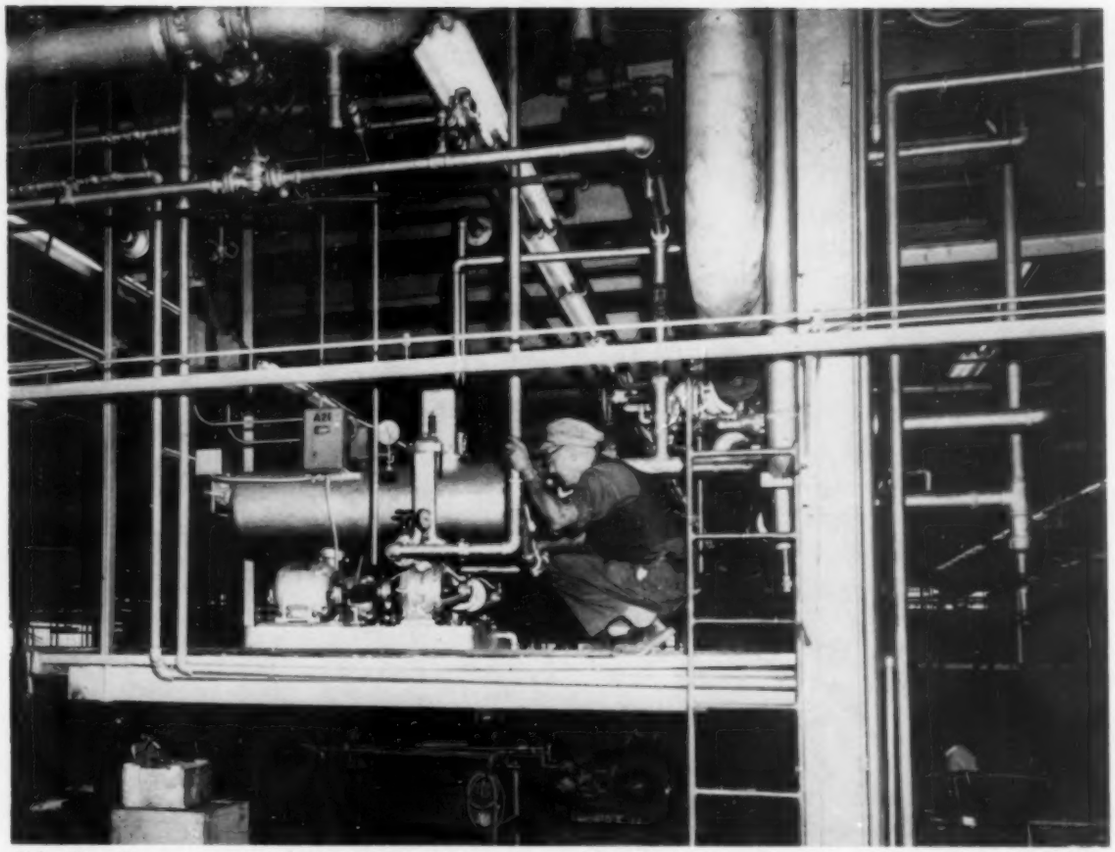
Each of the four boilers has 500 sq ft of heating surface, but the 125-hp units have a higher firing rate. Our two 125-hp units supply up to 4188 lb/hr of steam as compared to 3450 lb/hr from the 100-hp boilers. The older boilers have given us no operating difficulties in 8 years of steady service, and we expect the newer ones to do as well.

All four boilers are fired with No. 6 fuel oil. Fuel oil is continuously circulated by rotary pumps from underground storage to the boiler loop and back. Low back pressure is held on the leads to the boilers by a pressure release valve in the loop. Oil temperature is held at about 120 F, which is increased to 180 F by electric heaters at the burners.

One of our two 20,000-gallon underground oil storage tanks is heated by a steam coil and one by a water cartridge. Two Tuthill rotary transfer pumps keep the oil in constant circulation. We run on one tank at a time and allow the temperature in the second tank to drop 10 or 15 degrees. No trouble has ever been been experienced with fuel lines clogging. Electric heating coils are wrapped around pipelines between boilerhouse and storage tank to guard against boiler shutdown in cold weather. To date, these have not been needed.

Maintenance requirements are modest for the four boilers. Duties of John VanGemert, engineer in charge of the boilerhouse, include:

- Daily blowdown.
- Daily check of feedwater and treatment.
- Visual observation and flame adjustment.
- Clean burner nozzles once a week.
- Open up rear heads every summer for tube clean-



John Van Gemert services dual condensate return pump. This single pump handles condensate from all 23 heat exchangers. Minimum equipment requirement for system results in minimum maintenance time and expense.

ing, inspection, and thorough boiler overhaul.

This is all the maintenance necessary to keep our Steam-Paks in perfect running order. Emergencies sometime occur, but they have been neither frequent nor particularly serious.

From our viewpoint, the flexibility for continued expansion is the chief advantage of the package steam generator. Its mechanical draft requires only a small, low stack. No expensive chimney is needed. No foundations need to be dug. Floor space is saved by reduced unit size for boiler rating. The pre-piped and prewired unit cuts down considerably on installation costs.

Other advantages, less applicable to us but important are:

- Relocation is comparatively easy.
- Automatic operation by electric controls saves labor and assures uniform steam pressure.
- Quick steaming and fast starting combined with rapid heat transfer provides full operating pressure with minimum waiting time.
- Separate generators may be located close to each demand should steam be required in different parts of a large building. Our central plant is entirely satisfactory, but the demand-area type of installation has possibilities. ♦♦

Package boilers in this installation are made by York-Shipley, Inc., Dept. IP, 75 Jessop Place, York, Pennsylvania. For more information, circle 590 on READ-N-CIRCLE card on page 47 or 48.

You have all your accessories?

TOO OFTEN, we think of "accessories" as items that may be nice to have, but that are not really essential. When it comes to regulating steam pressure, though, "accessories" are necessities. Here is a checklist of vital accessories:

- Bypass valve
- Incoming steam pressure gage
- Drip and trap
- Strainer
- Stop valves on outlet side and on control pipe
- Pressure gage in pilot control pipe ♦♦

Steam pressure regulating accessories are made by Spence Engineering Co., Dept. IP, Walden, N. Y. For more information, circle 591 on READ-N-CIRCLE card on page 47 or 48.

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Sprague's *complete selection* of Unipak Capacitors in sizes from ½ to 15 KVAR makes it easy to install the right rating at the right spot . . . at the motor! Each is completely self-contained . . . requires no additional switches or fuses. Unique Sprague unit cell construction gives you maximum reliability, long term trouble-free service.

Write for complete information in Bulletin PF-1150, available free on request to Industrial Capacitor Division, Sprague Electric Company, 351 Marshall Street, North Adams, Massachusetts.

The mark of SPRAGUE *reliability*

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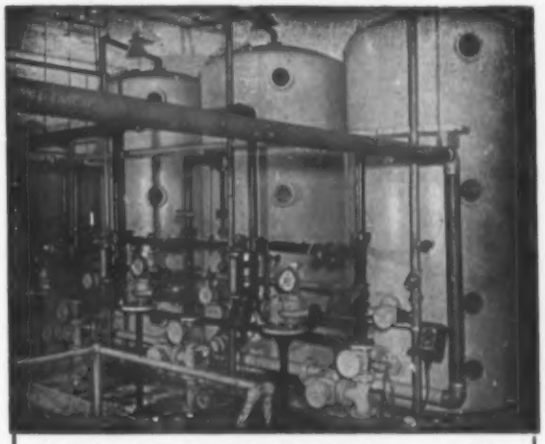

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One dependable quality

Manarch
renewable fuses

From raw material to final inspection every part is MADE and ASSEMBLED under our own quality control.

STRATEGICALLY LOCATED WAREHOUSE STOCKS

Manarch
ELECTRIC CORPORATION
Jamestown, New York

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what's so strange . . . .

about our willingness to send you INDUSTRY POWER without demand of a token subscription fee? Nothing, really. You see, no publisher of industrial magazines breaks even on subscription revenue . . . . not after he's paid out the costs of getting that revenue. (Why, then, are there any "paid" magazines? Because the "paid" designation permits mailing at cheaper, second-class rates than is possible for "controlled-circulation" magazines, such as INDUSTRY POWER.)

We prefer to hand-pick the men who will receive INDUSTRY POWER . . . . on the basis of continuing research that tells us who are the important men in our field. By selective hand-picking, rather than by extracting a token fee from anyone who might be susceptible to a subscription pitch, we can be sure that we reach the men who matter most in managing the power services. Is that so strange?

The Editors

In brief . . . .

First Energy Resources Conference

"Never before to our knowledge has there been a top-level conference bringing together representatives and spokesmen from every form of energy." With these words, the first Energy Resources Conference was opened in Denver this fall by Arthur L. Baldwin, president of the Denver Chamber of Commerce, sponsor of the conference. Baldwin sounded the conference keynote: "What are the influences of our energy sources upon the future of the world?" Here are briefs from some of the papers:

Economic possibilities for liquid fuels from oil shale and coal

W. C. Schroeder, professor and consulting engineer, University of Maryland.

"The effect of world-wide demand for increased energy ultimately will force the use of all available carbonaceous reserves; and, because of the strong preference for liquid fuels, will likewise create an industry for the conversion of solid fuels to liquid fuels.

"Estimation of the average capital cost for new and replacement productive capacity for petroleum in the United States indicates that it will increase from about $5900 per barrel per day for the period 1950 to 1955 to above $9000 for the period 1960 to 1965.

"Shale oil capital costs are estimated at $8000 per barrel per day of productive capacity and are now, or soon will be, comparable with the capital cost of domestic petroleum. Operating costs for the oil shale plant may be higher than for petroleum production and refining, but this difference will tend to disappear as the shale processes are further developed and as the costs for oil production in this country increase. Shale plants have a further advantage in that they can produce at a constant rate for at least 20 years, compared to an overall life of petroleum reserves of 12 years.

"The capital cost of a synthetic fuel plant using coal is esimated at about $13,000 per barrel per day of finished products. Since this estimate is based (1) on plant output instead of input as used in the petroleum industry, (2) on the production of a slightly higher percentage of the more valuable products, and (3) on a plant which will last at least 20 years, it is estimated to be comparable with petroleum capacity at about $9000 to $10,000 per barrel per day. These capital costs for petroleum will be reached sometime beyond 1960.

"The operating costs for synthetic fuel plants using coal are high. Costs for the coal itself are becoming more favorable as domestic oil prices increase. . . . Labor and equipment requirements for the synthetic fuel plants could be markedly reduced by (1) further research on simplification of the processes, and (2) a thorough engineering analysis of the detail of the process to simplify each step. This development and engineering work would only have to be modestly successful to put synthetic fuel plants using coal in a competitive position with domestic petroleum.

"The average capital cost of productive capacity abroad is estimated in the range of $3000 to $4000 per barrel per day for the next decade. Both domestic petroleum and synthetic fuels will have great difficulty competing with foreign oil if it moves freely and without restrictions in international trade. The question of cost as well as the desirability and need for domestic production must be weighed in determining how much oil the United States will import."

Energy resources for the future

Dr. John W. Vanderwilt, President, Colorado School of Mines

"The United States, exclusive of Alaska, has estimated recoverable reserves of some 950 billion tons of all ranks of coal. This is 38 percent of the world's known coal reserves. Because of cost factors and because much of the reserve is in lignite and sub-bituminous coal, [it has been] established that economically recoverable coal reserves in the United States may not amount to more than 223 billion tons — enough to last approximately 250 to 300 years at present usage rates.

"Our country's proven petroleum reserves total 35 billion barrels, and the total world's reserves are around 300 billion barrels. At current U. S. production of approximately 7 million barrels a day, this means our nation's reserves can be expected to last for roughly 14 years. Two factors must be taken into account in discussing these reserves,

however. The first is that estimates of proven reserves in the past have consistently been conservative. The second is that increased exploration activity aided by newly developed techniques in recent years have made for continued growth of known petroleum reserves despite greater usage of oil and gas. . . .

"During the past 5 years, domestic demands for crude oil have exceeded production and increasing quantities of imports have come from Venezuela and the Middle East, where very large proven oil reserves and production of oil have been developed. Higher costs associated with deeper drilling in the U. S. have also been a contributing factor to greater importation of petroleum. . . .

"Another obvious potential in the field of liquid fuel is the production of synthetic oil from oil shale and coal. The potential yield of synthetic oil from oil shale is estimated to be some 1000 billion barrels. At the current rate of consumption of petroleum, this would be adequate for 150 years, assuming only 50 percent recovery. . . .

"Only a few days ago, the world's first commercial use of atomic power was announced at Calder Hall in northwestern England, where electric generators powered by nuclear reactors were put into operation. Remaining coal reserves in Britain are large, but production costs are becoming prohibitive. Because of cost and defense considerations, a dependence on petroleum and coal imports to meet future needs would be undesirable in Great Britain. The nation has turned for an answer to atomic fuel. Precious supplies of petroleum and coal can be diverted to more pressing needs and the atom will take over in many conventional areas. . . . The situation in the British Isles illustrates the role that atomic power may be expected to play in our own nation. . . .

"And, of course, the development of solar energy. . . . could conceivably provide another virtually unlimited energy source.

"There are other energy sources as well. Water power has long been important to man, and today, is vital to the development of electricity. There is potential energy for man's use in wind power, temperature differences in tropical waters, thermoelectric effect, photoelectric cells, tides, natural steam, earth heat, ocean waves, atmospheric electricity, controlled biologic photosynthesis, and other fields of man's knowledge." ♦ ♦

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the LOCATOR

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see page 53

From Regina to Saudi Arabia

B-L VESSEL LININGS SET RECORD AFTER RECORD FOR DEPENDABLE PERFORMANCE

A FEW OF OUR RECENT JOBS

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Batangas, Philippines	Regenerator and Cyclones
Yokohama, Japan	Regenerator and Cyclones
Ras Tanura, Saudi Arabia	Regenerator—Reactor
Copenhagen, Denmark	Kiln Reactor
Antwerp, Belgium	Kiln
Norco, La.	Regenerator and Cyclones
Altona, Australia	Reactors
Mandan, North Dakota	Regenerator and Cyclones
Anacortes, Washington, U.S.A.	Regenerator, Reactor, Cyclones and Lines.

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There are good, solid reasons for this world-wide preference for Bigelow-Liptak jobs. In the first place from B-L's years of experience has come a complete castable package. Insulating- and abrasion-resistant castables are engineered, furnished and installed by the same company—which means just one contract and one responsibility.

The overall result of this all-in-one engineering is exceptional durability and performance. B-L refractory installations have established world records for continuous operation. For example, after initial runs of 785 and 610 days, B-L linings were in perfect shape—required no repairs during shutdowns.

Yes, from Regina to Saudi Arabia—and points in between—Bigelow-Liptak installations are setting new records for service and performance. For complete information write for the B-L catalog "One Source". Do it today!

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"We'll even throw in a few vice presidents with it."

how to get more engineers

Having a tough time finding engineers for your staff? **See page 11.**

Test askarel

. . . starts on page 16

cording to cleaning procedure outlined above. A bridge, such as General Radio type 544 B, is needed to maintain constant voltage on the liquid.

An oven with temperature control may be used to bring sample temperature to 100 ± 1 C and to hold this temperature during test. Remove thermometer and allow askarel to stand for about 2 minutes before testing. Keep oven closed during test.

Resistivity test gives a good indication of chemical contamination. As with any test, a chronological tabulation of properties is probably the best way to tell the condition of a transformer. Any rapid change of any properties is an indication that a change is taking place that could lead to breakdown. If resistivity is lower than shown in Table I, treating askarel with fullers earth will indicate if filtering will improve its properties.

what causes acidity?

Askarel acidity can be caused by several reactions with contaminants as well as by askarel breakdown with electric discharge. An arc under askarel produces finely divided carbon and gases that are almost entirely hydrogen chloride. Dry hydrogen chloride has little effect on metallic or insulating materials. If moisture is present, however, hydrochloric acid forms. This may damage insulating materials and rust ferrous metals, depending on concentration. of acid formed.

Considerable volume of many gases—such as oxygen, nitrogen, carbon dioxide, and hydrogen chloride—may be absorbed quickly and spread throughout askarel. When arcing has occurred in an askarel transformer, therefore, neither askarel nor core and coils should be exposed to atmosphere (which is always more or less humid) until the hydrogen chloride gas has been neutralized.

Discharging dry nitrogen gas from a cylinder through a pressure regulator into the bottom valve of the transformer tank will purge hydrogen chloride gas. Nitrogen will bubble through the askarel and should be vented from the top. This bubbling should be quite vigorous to agitate the liquid and carry off all hydrogen chloride gas. Provide extra ventilation to carry away hydrogen chloride after discharge from the transformer. Hydrogen chloride is both flammable and toxic. Amount of nitrogen to use and bubbling time is shown in Table II.

If a fault has occurred in a transformer, hydrogen chloride gas should be purged before removing askarel from the case and without regard for reclaiming askarel. This will prevent any askarel absorbed in the insulation or left on the parts from absorbing atmospheric moisture and becoming acid. Parts not damaged by the breakdown will be saved.

Acidity test is the amount of potassium hydroxide required to neutralize one gram of askarel. In this test, neutralize about 75 grams of askarel (which has been treated with phenol red) with 0.01 normal solution of potassium hydroxide. Complete description of the test is given in ASTM Test D 974. Table I contains a recommended maximum acidity neutralization value for satisfactory service.

corrosive chloride test important

Testing for corrosive chloride is important if the transformer has aluminum parts. It indicates corrosive property of the askarel. Test is made by determining the corrosive properties upon a piece of aluminum. Aluminum foil (2 in. x 4 in.) is heated with the askarel at 200 C for 6 hours in a clean flask. Askarel then is tested for acidity, appearance, color, and condition. Inorganic chloride test is made by comparing askarel spectrum with that of a known strength sodium chloride solution. Properties should be as shown in Table I.

TABLE II — BUBBLING NITROGEN THROUGH ASKAREL

Askarel in transformer	*Rate of bubbling*	*Time of bubbling*	*220-cu ft cylinders required*
Up to 200 gals	1½ cfm	5 hrs	2
200 to 1000 gals	3 cfm	5 hrs	4
1000 to 2000 gals	3½ cfm	6 hrs	6

If askarel has undesirable properties, possibility of improvement by treatment and filtering can be tested. Thoroughly mix askarel sample with an amount of fullers earth (less than 200 mesh) that is approximately 0.2 percent by weight of the askarel. Heat mixture to 50 to 60 C for 4 hours and stir occasionally. Filter mixture through filter paper in a Buchner funnel and vacuum flask, and test filtrate. If the treated askarel meets specifications it is suitable for reclaiming by filtering.

how to filter askarel

Askarel can be filtered with a modified filter press. It pays to use a filter press reserved for askarel alone. If an oil filter press must be used, however, the press pump and all piping should be disassembled and thoroughly washed with lead-free gasoline and carbon tetrachloride to remove all traces of transformer oil. Oil is readily absorbed by askarel and minute amounts of oil will destroy the nonflammable properties of askarel.

Fullers earth must be used in the filtering process because filter paper alone will not remove the im-

purities. A 7-inch filter press with deep frames, double inlet and outlet connections, and provision for blowing out with compressed air is recommended for purifying askarel.

To prepare the filter for operation, place three sheets of standard filter paper between each plate and frame and then clamp press securely. Approximately 1/3 of a 5-pound charge of 180/300 mesh fullers earth then should be mixed with about 4 gallons of askarel in a clean tank or pail and circulated through the filter. After circulating a few minutes, the remaining fullers earth gradually should be mixed with the askarel and circulated until the filtrate clears up. This indicates that all fullers earth has been deposited in the filter and the press is ready for use.

One charge of fullers earth is usually sufficient for a period of two or three hours continuous running, depending on the amount of contamination present. To change the charge, blow dry compressed air through the press for about 10 or 15 minutes to

Dielectric test determines moisture content and contamination through inorganic insulation breakdown.

expel as much liquid as possible. Open the press, remove used fullers earth and filter papers and recharge the press.

Always filter from top of the tank and return filtrate to the bottom, because any moisture will collect on the askarel surface.

Askarel must not be filtered below 20 C. If the askarel has been below 10 C at any time, it should be heated to 50 C and circulated before filtering to redissolve any solid that has separated out.

If these tests are carried out conscientiously, there is no reason why your transformer askarel should let you down. Equipment required is relatively inexpensive, tests are simple, so it's cheap insurance to check up regularly. ♦♦

New Automatic Precipitator Control by

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offers many vital advantages...

1 LONG LIFE

This new control has indefinite life expectancy under all types of operating conditions. There are no tubes to replace, no high speed relays, counters, or timers to maintain. All circuitry consists of rugged "static" devices that have unusually long life!

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Optimum Precipitator power input is maintained regardless of operating conditions. The sensing control is simple, positive, accurate—and automatically evaluates the spark "Power Value" (intensity and frequency)—not just frequency or intensity alone.

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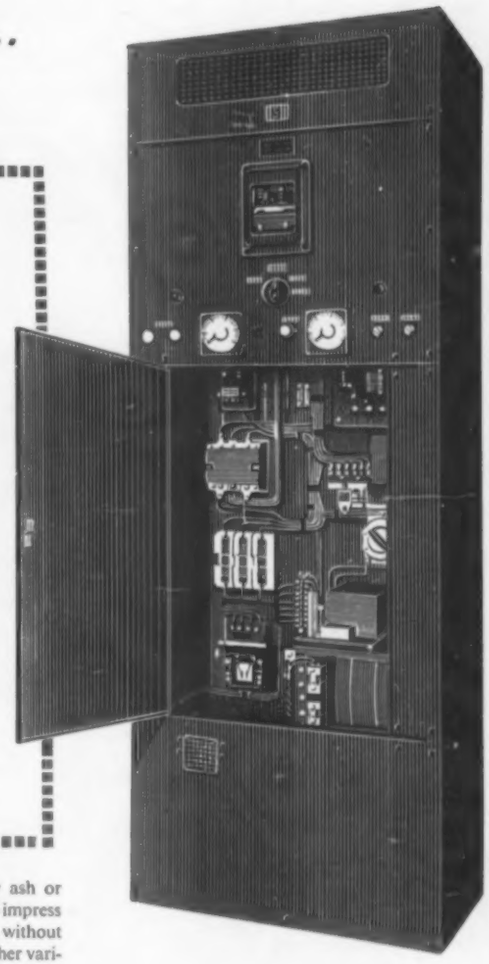
Modest initial cost coupled with negligible maintenance assure optimum operating efficiency (therefore lower operating costs) throughout many years of continuous service.



WHEN using a Cottrell Precipitator for collecting dust, fume, fly ash or other suspensions from industrial gases, it is essential at all times to impress on the high voltage system the highest possible voltage and current without "flashover". Depending upon gas conditions, dust loading and other variable factors, the optimum voltage and current requirements vary widely from one minute to the next. Therefore, the vital importance of a simple, trouble-free and highly sensitive Precipitator Control is self-evident.

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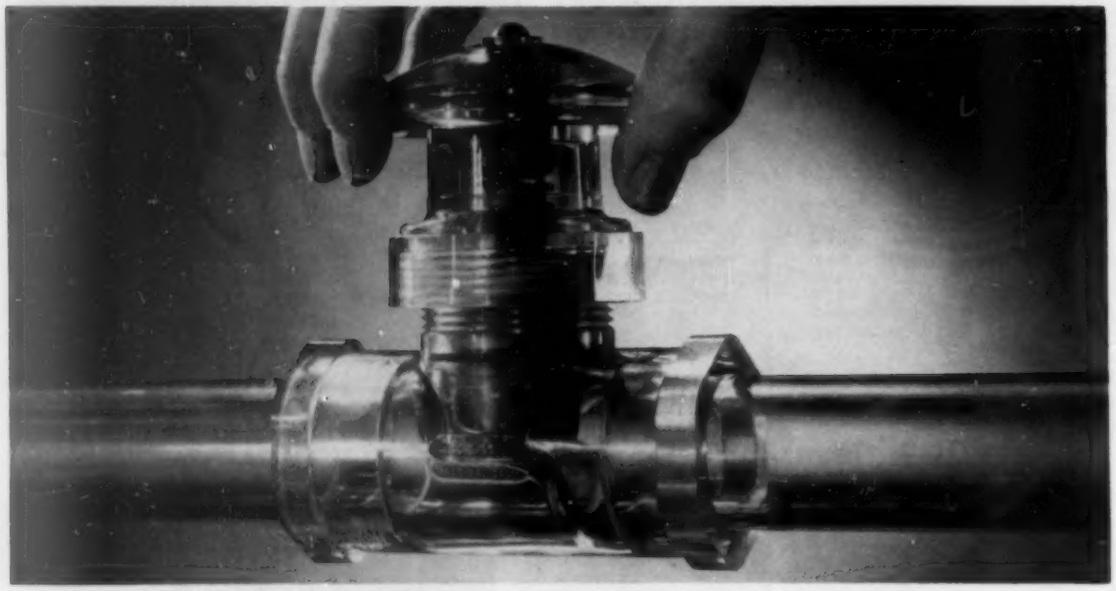
DUALAIRE Reverse-Jet Filters
HOLO-FLITE Processors

new products

. . . just circle key numbers on READ-N-CIRCLE card on pages 47 or 48

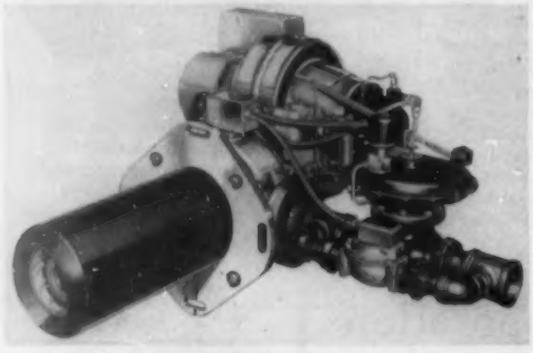
700-Transparent valve will not corrode

New globe-type valve never rusts. Resists corrosive action of many chemicals. Valve's interior surfaces, made of durable Tenite butyrate plastic, are extremely smooth, permitting unimpeded flow. When closed, a positive plastic-to-plastic seal is formed. Washers are eliminated, reducing deterioration and downtime. Transparent valve permits observation of flow. New valve is available with either plain or threaded ends for connection to plastic or threaded metal pipe. Solvent welding with clean pipe permits inspection of weld. SLOANE MANUFACTURING CO.



701-Burners work against pressure

Pressure burners work against combustion chamber back pressures of 3 inches wg or more. Burners are specially suited for economically firing scotch marine-type boilers and similar compact units. Burners do not require high stacks or induced draft fans. Equipment handles boilers from 10 to 150 hp. Three different types are available — gas-, oil-, or combination gas-oil firing (with manual or automatic changeover). Equipment features built-in controls for pre-purge, post-purge, and high-low-off fire. SYNCHRONOUS FLAME, INC.

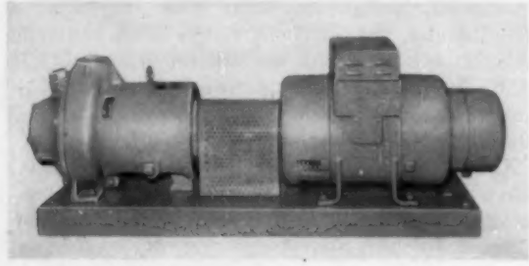


702-Hand lamp is explosion proof

Lightweight, portable, explosion-proof hand lamp is now available for use in flammable atmospheres. Fixture is Underwriters' Laboratory approved for Class I, Group C, or Class I, Group D locations. Lamp's cone-shaped aluminum body is rigged with heat dissipating fins. Plastic-coated fiber handle remains cool after lamp has been in use for long periods. To relamp, just remove threaded cover, guard, and lens assembly, then replace lamp. Lens is not disturbed since it is an integral part of the cover assembly. For areas where moisture is prevalent, a special model is available with O-ring gaskets at relamping joint and terminal housing. Fixture weighs less than 11 pounds, and uses 150-watt lamp. CROUSE-HINDS CO.

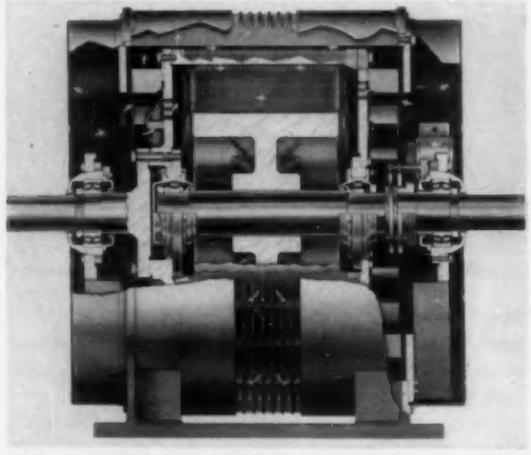
703-Turboalternator for standby power

Regular or standby requirements can be met with new 60-cps ac turboalternator. Unit combines mechanical drive turbine, generator, exciter, and voltage regulator in a single unit. Unit provides constant voltage for facilities where utility failure might prove disastrous. Units are available in capacities from 3.75 to 25 kva, single or three phase, and 120/208, 240, or 480 volts. Equipment can be furnished drip-proof, splash-proof, and explosion-resistant. THE PYLE-NATIONAL COMPANY.



704-Magnetic couplings are smaller

New concept in air cooling and important mechanical design changes result in reducing size of magnetic slip couplings by 1/3. Single basic design now is used for all sizes and ratings from 200 hp to over 2500 hp. Cooling air is drawn axially past rapidly turning ring, coupled or belted to driving motor, and forced into circumferential grooves. Air turbulence gives high rate of heat transfer. Fresh air is also forced past magnet-member winding. Internal bearings between ring and magnet members maintain positive alignment, eliminate overhung rotor load. Weather-protected construction for safe outdoor operation is also available. Magnetic drives control speeds of boiler draft fans, centrifugal pumps, and test stand equipment. Several units are being built to control speed of 2500-hp boiler feed pumps. During steady operation, coupling automatically maintains output within ±½ percent of desired speed. ELECTRIC MACHINERY MFG. COMPANY.



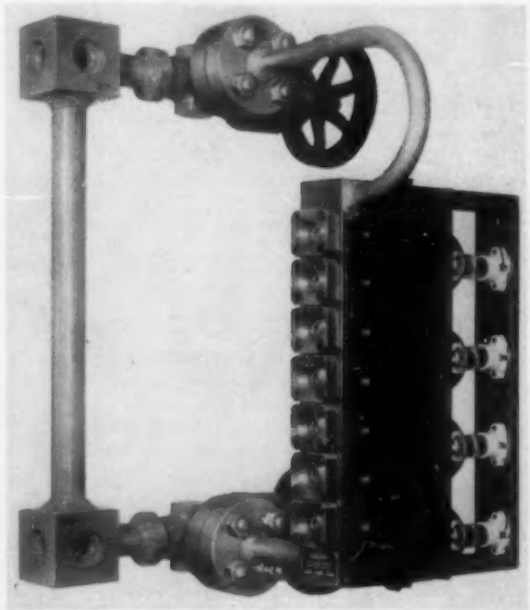
705-High-frequency drill cuts rapidly

Portable electric rotary hammer delivers 6000 blows/min. Percussion drill cuts a clean, true hole as much as 40 feet deep through stone, rock, or concrete. Unit is powered by electric motor and operates on any plug-in

115-volt ac or dc current. No transformers or rectifiers are required. Lightweight unit weighs 10 pounds and enables one man to perform difficult overhead work with ease. Unit drills from 3/16-inch to 1½-inch diameter holes for piping or electric installations. DEMO-HAINES TOOL CORPORATION.

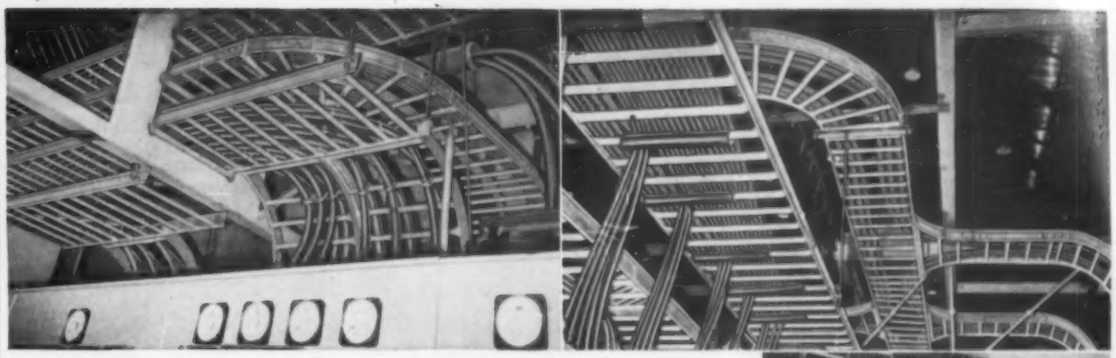
706-Two-color water gage gives warning

Two-color red and green water gage gives brilliant, contrasting indication of water level. Water shows green, steam shows red. Color-Port water gages are designed



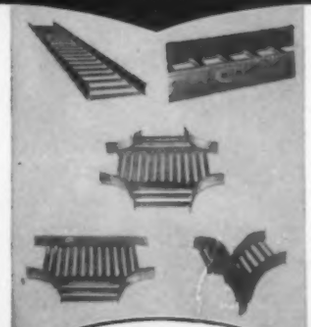
for high-pressure boilers up to 3300 psig. Individual cover-glass assemblies permit quick, easy servicing of the gage while in place. YARNALL-WARING COMPANY.

(more new products on page 34)



WHAT AN INSPIRATION—
this installation of...
Globetray* RACEWAYS
at
INSPIRATION COPPER MINES
Miami, Arizona

EASY TO INSTALL • SAVES TIME
SAVES ON MATERIAL • GALVANIZED
NO MAINTENANCE PROBLEM



Globetray, a new, superior system of CABLE and TUBING RACEWAYS, is a completely engineered method of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The Universal splice plate joins all parts through the side channels only and all curved fittings are joined at the ends of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Available in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Globetray can be cut to length at *any* point — insides and bottom always smooth — all sections punched for easy installation — a perfect fit at all times. Neat, clean and uniform in appearance.

Write for new, complete catalog. Distributors in all principal cities. Contact the Globetray distributor under "conduits" in the classified telephone directory.

* Pat. Pending

Globetray
THE GLOBE COMPANY

The GLOBE Company
Manufacturers Since 1914
4036 S. PRINCETON AVE. • CHICAGO 9, ILL.

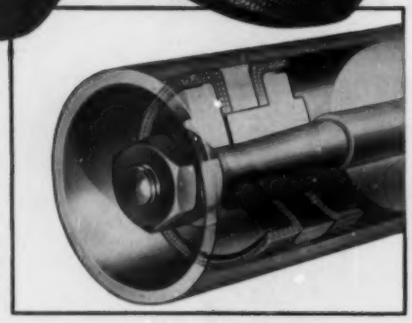
Circle 111 on READ-N-CIRCLE card for more data

PUMCUP ADVANTAGES

now yours for

- HYDRAULIC CONTROLS
- AIR CYLINDERS
- RECIPROCATING PUMPS

Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.



Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary piston packing . . and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

Improved application of the cup principle does the trick. And Darcova Pumcups are *texture-engineered* in *a range of compositions* to meet most temperature-pressure-fluid conditions. And they are available in sizes and types exactly right for your particular equipment.

It will pay you to get *all* the facts. Just ask for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 9, Pa.

DARCOVA THE ORIGINAL COMPOSITION CUP
TRADE MARK PUMCUPS

Circle 105 on READ-N-CIRCLE card for more data

new products

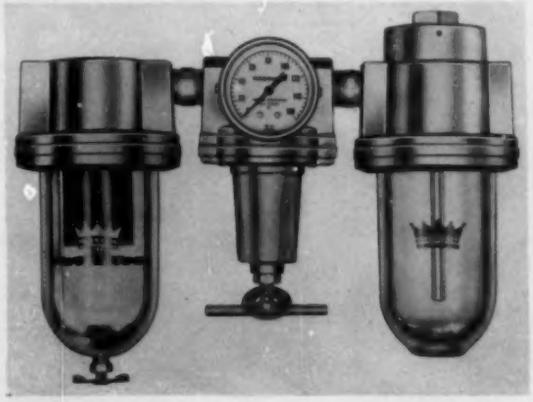
. . . starts on page 32

707-Easy-to-apply plastic insulation

Flexible foam-plastic sheet insulation adapts itself to curved or irregular surfaces with minimum fitting or cutting. Flexibility of new sheet is particularly adaptable toto insulating large tanks, irregularly shaped vessels, oversize pipes, refrigeration and air-conditioning equipment. Material withstands temperatures up to 160 F. Low temperature limit is within normal ambient limits. Sheets have a k factor of 0.28 at 75 F mean temperature and water-vapor permeability of 0.1 perm. Sheets (30 by 36 inches) are available in thicknesses of ⅛, ¼, ½, and ¾ inch. Foam-plastic sheets are applied with adhesive and require no mechanical support. No vapor barrier is necessary, but a coat of aluminum or asphalt paint is recommended for outside installations. ARMSTRONG CORK COMPANY.

708-New filters, regulators, lubricators

New line of filters, regulators, and lubricators is available for compressed air lines throughout industry. Units provide effective filtration, regulation, and lubrication with minimum power loss. Equipment provides maximum air flow capacity for rated pipe sizes. Modern design and simplified construction offer many advantages in plant air systems, for air cylinders, and for air tools. HANNIFIN CORPORATION.



What's your need for heat?

Whatever your heating job may be, you'll find the efficient, economical answer in . . .

CHROMALOX Electric Heaters

. . . for heating platens, dies, molds, metal parts . . . for heating liquids, air, gases . . . for curing, drying, baking . . . for comfort heating in offices and factories . . . for special applications . . . in fact for any application requiring fast, low-cost, controlled heat up to 1100°F.

IMMEDIATE DELIVERY

from the world's largest factory stock of industrial electric heaters . . . over 15,000 types, sizes and ratings.

Let the Chromalox Sales-Engineering staff solve your heating problems . . . electrically.

Write for your copy of Catalog 50

Contains helpful information on design uses, and prices of Chromalox Electric heaters, elements, thermostats, contactors and switches.

To get some interesting facts about additional applications of electric heat, ask for Booklet F1550—"101 Ways to Apply Electric Heat."

Edwin L. Wiegand Company
7520 Thomas Boulevard, Pittsburgh 8, Pennsylvania

EDWIN L. WIEGAND COMPANY
7520 Thomas Boulevard, Pittsburgh 8, Pa.

I would like to have—

☐ A copy of Catalog 50
☐ A copy of "101 Ways"
☐ A Sales-Engineer contact me

Name_____
Company_____
Street_____
City_____ Zone____ State_____

A-4495A

Circle 124 on READ-N-CIRCLE card

"It's the most practical of all!"

SAYS
Jim Gardner
President
The Cincinnati Tool Co.

* * *

About the Improved

SPEARHEAD EXTENSION GASKET CUTTER

"In the past 50 years we've tested virtually every gasket cutter on the market, but without question, this new extension model is the most practical yet! It has the simplest, most practical design of any gasket cutter, I've ever seen . . . the aluminum body is lightweight and has smooth rounded edges that makes it convenient to handle. Its wide range of uses amazes me. I was sold the first time I tried one!"

•
•
•

You'll be sold, too, after you try one and prove to yourself how efficient this new Spearhead Extension Gasket Cutter really is. This hand tool will cut solid diaphragms and disks, shims, patterns and round gaskets any size. Pliable sheet materials like .005" vegetable fibre, 1/8" compressed asbestos, and 1" rubber can be readily cut.

•
•
•

This tool belongs in every man's tool kit. Now available through more than 2,000 distributors the world over.

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•

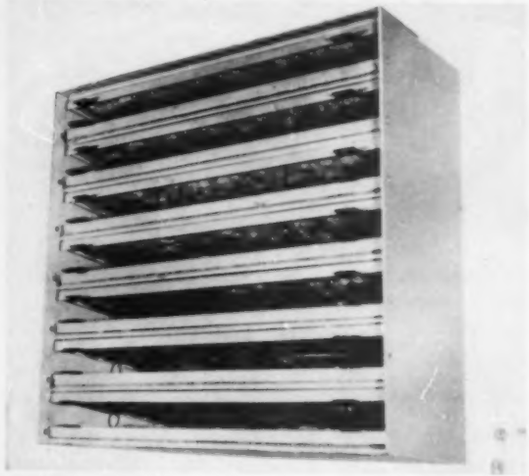
Contact your local supplier for complete information and prices, or write to . . .

ZIMMERMAN PACKING
CINCINNATI 12, OHIO

Circle 126 on READ-N-CIRCLE card

709-Get dry-type air filters

High-efficiency dry-type renewable media air filter gives higher-than-normal cleaning efficiencies. Filtering media ranges from inexpensive cellulose fiber sheets, through dense, highly effective glass fiber mats. Variety



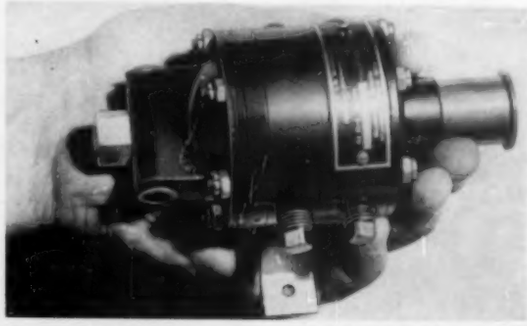
of thicknesses, densities, and textures make it possible to obtain any desired efficiency in dust and smoke removal. Permanent media frames insure a perfect seal and makes media servicing simple and inexpensive. AMERICAN AIR FILTER CO., INC.

FOR MORE INFORMATION

For more detailed free information on these products just circle the key numbers on a READ-N-CIRCLE card on page 47 or 48.

710-Transmitter checks flow losses

Six-range differential transmitter easily and economically checks losses of steam, water, and air in plant consumption. Unit is easily applied where more expensive equipment is not economical. New unit controls liquid level, consistency, or low-pressure air or gases



(up to 10 psig). Unit measures 6½ by 3 inches, weighs 4½ pounds, and can be pipe mounted. Maximum working conditions are 150 psig and 150 F. Air supply pressure is 20 psig, air consumption 0.10 scfm. Output pressure range is from 3 to 15 psig. TAYLOR INSTRUMENT COMPANIES.

(more new products on page 36)

"Heat loss through these shipping room doors was tremendous until Reznor suggested this answer"

"Until these Reznor heaters were installed, our shipping room crew might as well have been working outside during cold weather. Whenever those big doors were open, the cold wind came blasting in, making everybody uncomfortable, unhappy, and inefficient. Reznor gas unit heaters have eliminated all that. Installed so that they discharge across the door areas, they lay down a curtain of warm air which keeps winter outside where it belongs. And they operate completely automatically . . . putting out a powerful blast of heat within a few seconds after the doors are open. The lesson we learned here has been applied to eliminate trouble spots in other parts of the plant, too. It's paid off in better health, morale and efficiency among our workers."

Only Reznor Gas Unit Heating Offers All These Advantages

- Low Equipment Cost
- Low Installation Costs
- Low Operating Costs
- Instant Response to Every Change in Temperature
- No Maintenance Problems
- Waste No Floor Space
- Extra Heat for Trouble Spots
- Complete Adaptability to Future Construction

For more information mail the coupon below or call your nearby Reznor distributor. He's listed under "Heaters-Unit" in the yellow pages of your telephone directory.

REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT HEATERS

REZNOR MANUFACTURING COMPANY
70 Union Street, Mercer, Pa.

☐ Please send me my free catalog on Reznor gas heating equipment.
☐ Please have a representative call to discuss our plant heating problems.

Name..... Title.....
Company.....
Street.....
City..... State.....

Circle 120 on READ-N-CIRCLE card for more data

To the experienced eye, a lot of coal "looks" good—well prepared, well-balanced size consist, carefully loaded. And this is important, too, for it reflects the care which has gone into the preparation of the product for market.

There's more to it than meets the eye, though, and it is for these unseen qualities that more and more buyers have come to rely upon Guyan Eagle products.

How about inherent quality? Guyan Eagle coals, mined from Island Creek (Cedar Grove) and Elk Creek "C" seams of southern West Virginia, are high quality products to begin with, further improved by careful preparation and quality control.

How about uniformity? You can depend upon Guyan Eagle, from car to car, day to day, year after year, to ship coal of uniform quality, every car prepared to your specifications.

How about reserves? Guyan Eagle production is backed up by 240,000,000 tons of high quality reserves, assuring you a dependable source of supply for many, many years to come—well into the next century, for that matter.

So, no matter whether you're looking for coal for commercial, industrial, utility or by-product application, you'll find a Guyan Eagle product to meet your requirements. Order a trial car today—see for yourself.

GUYAN EAGLE

COAL COMPANY

DETROIT NEW YORK

HUNTINGTON 1, W. VA.

CHARLOTTE RICHMOND

CABLE ADDRESS: GUYANEGLCO

Circle 144 on READ-N-CIRCLE card for more data

new products

. . . starts on page 32

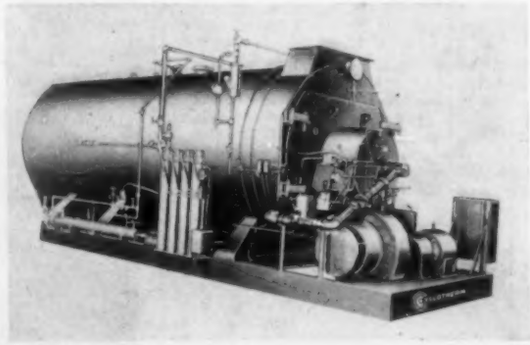
711-Adhesive repairs wood block floors

Factory-mixed cold adhesive resets, repairs, and reseals wood block floors. Cold application eliminates heating kettles, fire hazards, and obnoxious fumes. Floor repairing and resealing can be done in sections without

interrupting production. Compound dries quickly and can be driven over within an hour after application. Water-resistant compound prevents moisture from penetrating cracks, greatly lengthening floor life. Compound is available in 5-gallon cans and in 30- and 55-gallon drums. THE MONROE COMPANY, INC.

712-This package contains 750 horsepower

Package steam generator developing 750 horsepower is the highest capacity fire-tube boiler available today. New unit delivers 26,000 lb/hr of steam at over 80-percent efficiency. Unit is designed for heavy oil or gas, but can be adapted to burn either LP gas or light oil. Modulation over an extremely wide range permits



efficiencies of 80 percent even when operating at a small fraction of rated capacity. Units open new prospects for plant installations with high efficiency, simplified automatic operation, compact size, minimum stack requirement, and unified operating responsibility. This unit expands the package boiler line to include units from 18 to 750 horsepower. CYCLOTHERM DIV., NATIONAL U.S. RADIATOR CORPORATION.

PALMER

presents

an outstanding improvement in

DIAL THERMOMETERS

external calibration

Full 3½" Dial Face

- No Sector
- No Pinion
- No Linkage
- Constant Accuracy
- Easy Readability

WRITE FOR BULLETIN 350

PALMER

THERMOMETERS, INC.

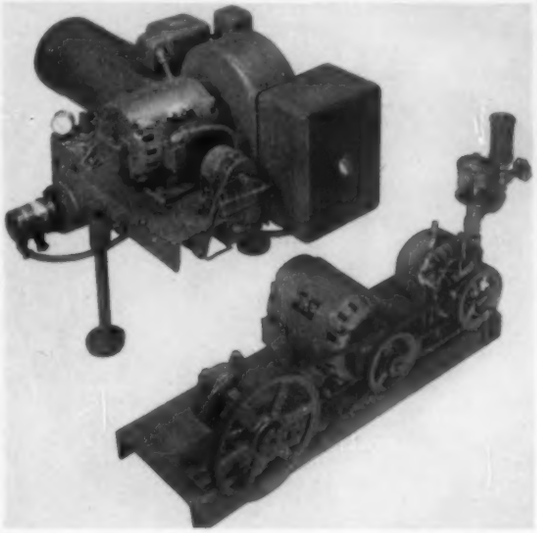
Norwood Ave., Cincinnati 12, Ohio

Mfrs. of Industrial Laboratory Recording and Dial Thermometers

Circle 119 on READ-N-CIRCLE card

713-Boost oil firing efficiency

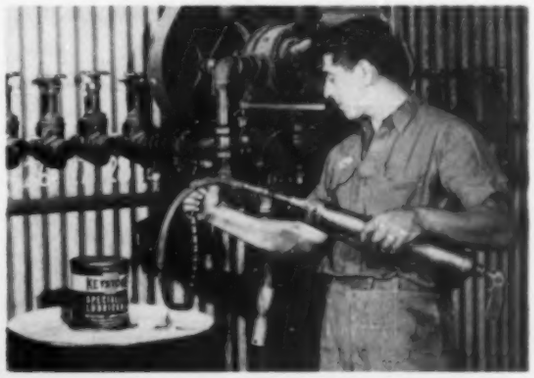
Fuel savings up to 30 percent may be effected with new York-Power oil burners. A 2000-watt electric preheater heats oil to burning temperature. Burner handles No.'s 1, 2, 4, and 5 fuel oils. Salient features are metered air control, built-in viscosity compensator to assure constant firing rate regardless of oil viscosity, and



improved air-oil atomizing nozzle. Small-size flame at startup assures safe ignition without flarebacks. Compressor, fuel pump, and motor are located on separate chassis, which may be either wall or ceiling mounted. Burner comes in sizes: TH-60 (60 hp), burning from 5 to 20 gph, and TH-84 (84 hp), burning from 7 to 28 gph. YORK-SHIPLEY, INC.

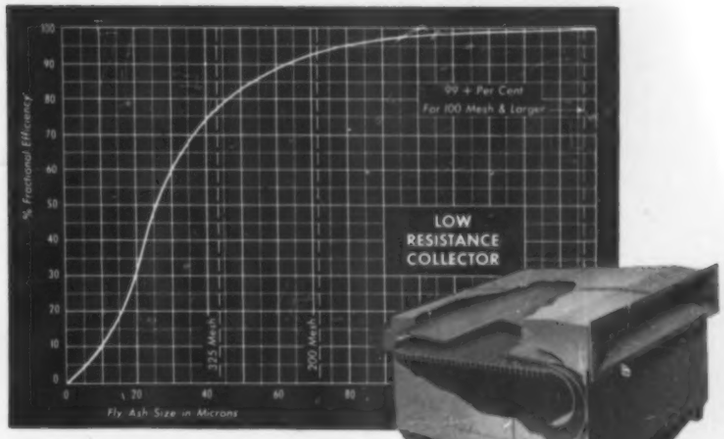
714-New grease prevents corrosion

New line of acid- and alkali-resistant greases provides effective protection against more than 100 corrosive agents and solvents. Three types are available for op-



erating temperatures from 0 to 350 F. They are made in four consistencies (heavy, medium, light, and extra-light) and have ASTM penetration range of from 200 to 350. These greases lubricate plain and antifriction bearings, driving chains, pump packing glands, and lubricated plug valves. KEYSTONE LUBRICATING CO.

(more new products on page 38)

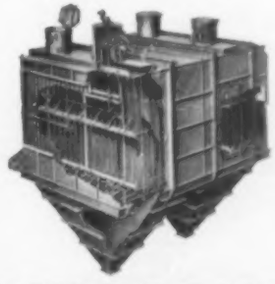

% Fractional Efficiency
99 + Per Cent For 100 Mesh & Larger
325 Mesh
200 Mesh
Fly Ash Size in Microns
LOW RESISTANCE COLLECTOR

Buell "LR" Fly Ash Collectors Deliver Top Efficiency on Natural Draft!

Buell "LR" units have no moving parts to get out of order, require no cleaning or water, yet collect *over 99%* of fly ash 100 mesh or larger, even on natural draft! Simple design gives minimum draft resistance, plenty of extra capacity to handle overloads. It's the perfect fly ash collector for high or low pressure boilers from 100 to 2,000 BHP!

BUELL CYCLONE COLLECTORS also deliver extra efficiency, owing to exclusive Shave-off which harnesses the double-eddy and puts it to work!

WRITE FOR FREE BROCHURE giving complete design and performance data on the Buell "LR" Fly Ash Collector. Write to Dept. 90-K, Buell Engineering Company, 70 Pine Street, New York 5, N. Y.



BUELL "SF" ELECTRIC PRECIPITATOR with exclusive Spiralectrodes and Continuous Cycle Rapping deliver the valuable extra percent of efficiency.

buell

MECHANICAL ELECTRICAL

Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

Circle 104 on READ-N-CIRCLE card for more data

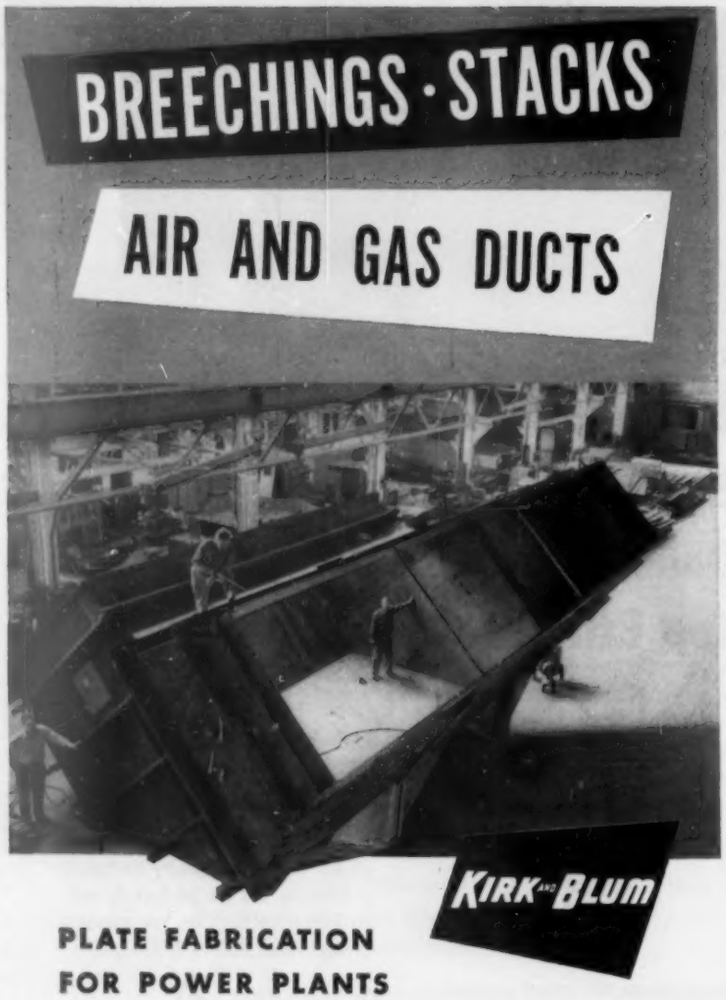


PLATE FABRICATION FOR POWER PLANTS

Whatever your requirements in fabricated plate, sheet or structurals for power plant use . . . call on experts!

Kirk & Blum has fabricated a variety of power plant needs as big as the mammoth breeching section shown here. In a 150,000 sq. ft. plant, with crane capacity to 25 tons, Kirk & Blum has complete facilities to produce, preassemble and load the largest fabrication. Kirk & Blum has the men, materials and experience to do the job quickly and economically.

For detailed literature, write: The Kirk & Blum Mfg. Co. 3174 Forrer St., Cincinnati 9, Ohio

KIRK & BLUM

FABRICATION

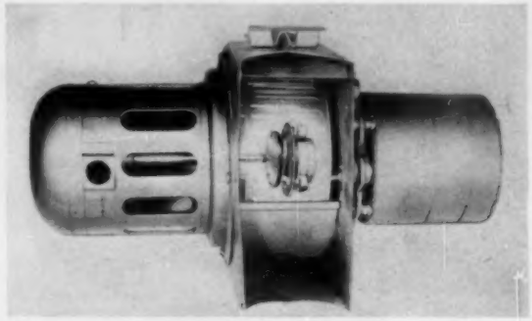
Circle 137 on READ-N-CIRCLE card for more data

new products

. . . starts on page 32

715-Switch prevents blower failure

Centrifugal switch protects gas burner against blower failure. If blower speed falls below normal, centrifugal switch actuates controls to shut off gas flow immediately. Switch is mounted on blower shaft to operate in con-



junction with mercury switch. Accurate to ± 3 percent of blower rpm, it operates on speed alone . . . . independent of voltage, load, or heat conditions. Switch has dependable operating life in excess of 1,000,000 cycles. TORQ ENGINEERED PRODUCTS CO.

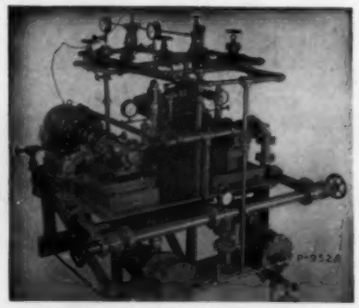
716-Portable pH meter for field tests

Portable, self-contained, pH meter requires no external power supply. Recommended for field surveys of stream pollution, waste-treatment plant effluent, and industrial water supplies. Meter covers total pH range

in two partial ranges of 0 to 8 and 6 to 14. Carbon-coated 8-inch diameter charts can be set for one revolution in either 1 or 24 hours. Manual adjustment compensates for temperature variations. Electrodes are available for immersion, flow, and laboratory applications. THE BRISTOL COMPANY. ♦♦

COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

MORE COMPACT THAN EVER . .



P-952-A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

NATIONAL AIROIL

FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return, and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40—very interesting and informative.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1368 E. Sedgley Avenue, Philadelphia 34, Pa.
Southwestern Division:
2512 South Boulevard, Houston 6, Texas

Circle 116 on READ-N-CIRCLE card

names make news

. . . personalities from industry power

Engineers Council for Professional Development elects **Morris D. Hooven** president. Hooven is an engineering executive with the Public Service Electric and Gas Co. He is past president of AIEE.

American Chemical Society's Division of Industrial and Engineering Chemistry awards its Scroll of Honor to **Dr. William A. Pardee,** chemical engineer at Gulf Research and Development Co. He was honored for his contributions to the "growth, success, and prestige of the Society and the division."

Harry A. Kuljian, Kuljian Corp.'s founder, is honored at a celebration banquet on the firm's 25th anniversary. Kuljian, a penniless immigrant 40 years ago, gives credit to "this land of opportunity" for his success.

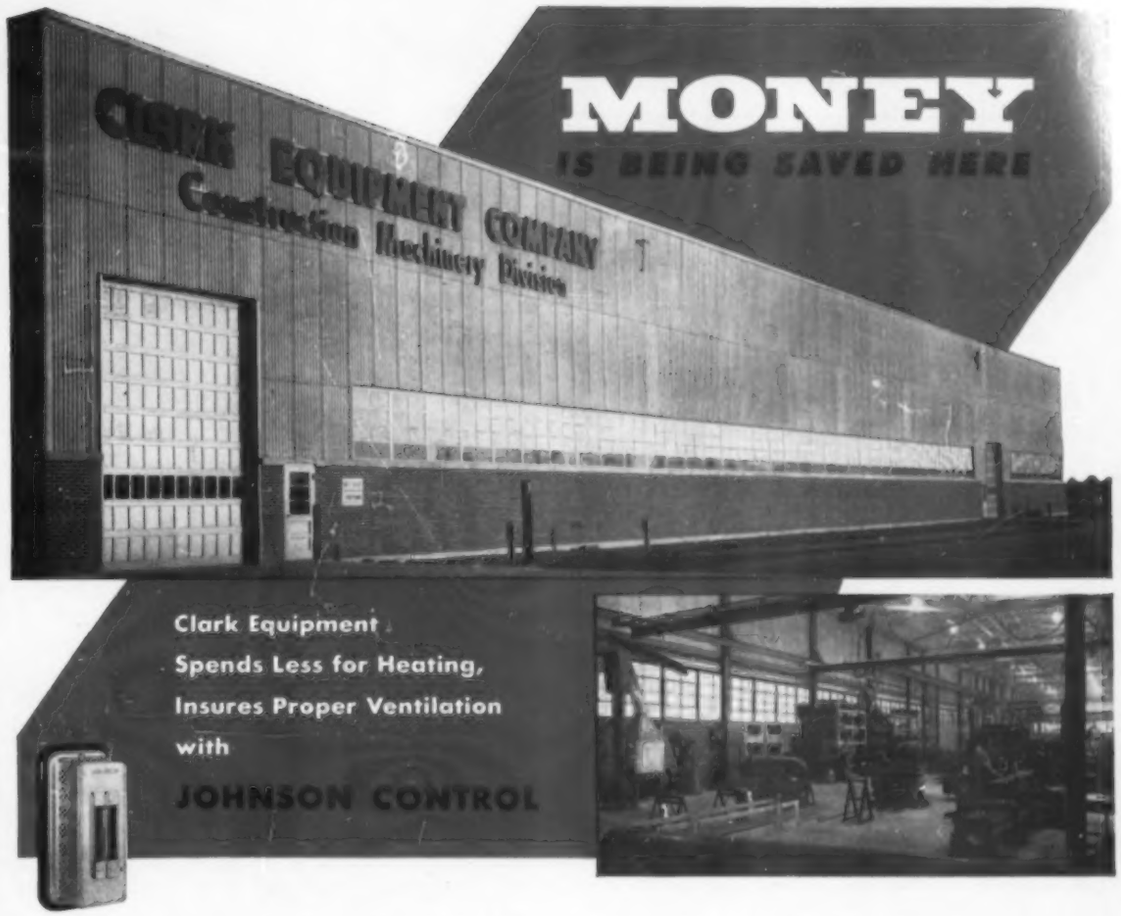
Iddles

Otto

Atomic Industrial Forum elects **Alfred Iddles** president. Iddles, president of Babcock & Wilcox Co., is a charter member of the Forum. He has been vice president and a member of its executive committee since its founding in 1953.

Purolator Products, Inc. announces appointments. **Herbert R. Otto, Jr.,** formerly chief engineer, heads new Technical Service Department. **Frederick R. Gruner** becomes chief engineer.

AIEE elevates 16 members to rank of Fellow: **Constantine W. Bary,** Philadelphia Electric Co.; **Reginald R. Benedict,** University of Wisconsin; **Charles T. Button,** Wright Machinery Co.; **Laurence K. Del'Homme,** Houston Lighting & Power Co.; **George D. Floyd,** Ontario Hydro; **William T. Hess,** Louisiana Power & Light Co.; **William D. Kyle, Jr.,** Kyova Fiber Pipe Co.; **Leon Podolsky,** Sprague Electric Co.; **Ellery H. Raddin,** Champion Lamp Works; **Walter Schaelchlin,** Westinghouse Electric Corp.; **Royal D. Sloan,** Washington State College; **John Wallis,** Oklahoma Gas & Electric Co.; **Raymond R. Wisner,** Stone & Webster Engineering Corp.; and **William J. Dowis, Thomas D. Gordy,** and **Edward E. Lynch,** General Electric Co. ♦ ♦



The rows of closed windows at this modern Clark Equipment Company* plant illustrate a means of saving money that is readily available to any industrial building. Here, just a simple application of Johnson Thermostats, Valves and Damper Operators is all it takes to provide comfortable, healthful working conditions and eliminate the needless heat waste of "open window" ventilation.

Strategically located Johnson Thermostats direct the operation of six 20,000 cfm heating and ventilating units. In order to maintain the desired temperatures throughout the 150,000 square foot structure, thermostats compenstate for the heat-producing effects of equipment used in fabricating and assembling operations as well as for the effects of changes in outdoor temperatures. Outdoor air for ventilation is then heated only enough to maintain the correct space temperature.

There's no underheating and, more important, no overheating to require wasteful "open window" ventilation. Both temperature and ventilation needs are fully satisfied at the lowest possible fuel cost.

Additional space temperature control is economically provided by other Johnson Thermostats which regulate face and by-pass dampers on nine door blast heating units.

The successful performance of this money-saving system led to further installations. Since the building was completed in 1954, Johnson engineers have been called on to design the automatic control systems for both a small and large addition to the plant, a new two-story office building and a smaller, field office building.

Whether it's comfort control you need or protective temperatures and humidities for products and processes, the specialist Johnson organization has the answer. An engineer from a nearby Johnson branch will gladly demonstrate how, on your specific problems of heating, cooling, and ventilation control, Johnson can give you superior control performance and reduce your operating costs. No obligation, of course. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

*Clark Equipment Company, Construction Machinery Division, Benton Harbor, Michigan. The Austin Company, engineers and builders, Chicago.

JOHNSON CONTROL
SINCE 1885
PLANNING • MANUFACTURING • INSTALLING

Circle 139 on READ-N-CIRCLE card for more data

new bulletins

. . . just circle key numbers on READ-N-CIRCLE card on pages 47 or 48

400-Charts compare welding rods

Bulletin DH-1218-J includes charts showing typical uses of gas welding rods, bare electrodes, automatic welding wire, and metal spray wire. Lists analysis, tensile strength, elongation, average Rockwell hardness, and physical properties as welded. Four pages. AMERICAN CHAIN & CABLE CO. INC.

401-How to calculate illumination level

Bulletin L-110-E includes data on brightness, light distribution, and illumination-level calculations. Describes Twinlite lens panel for use in high ceiling troffers. Four pages. CORNING GLASS WORKS.

402-Industrial V-belt handbook

Fully indexed handbook gives details of V-belt construction, data to help in selecting V-belts, hints on maintenance, and operating data on V-belt drives for most standard motor speeds. Seventy pages. QUAKER RUBBER DIV., H. K. PORTER CO., INC.

403-How to bring gage face to eye level

Installation sketches in Bulletin WG-1814 show mirror arrangements that bring Color-Port gage face to easy-to-read eye level. Port-type arrangement and two-color readings aid visibility, reduce maintenance. Six pages. YARNALL-WARING CO.

404-Valve sizing data

Series LB control valves have single-seated split valve body design with cylinder Conomotor actuator. Bulletin LB-2 includes formulas for sizing valves for liquids, gases, steam. Twelve pages. CONOFLOW CORP.

405-Circuit breaker engineering data

Schematic diagrams, time-delay curves, basic design considerations, voltage drop curves, and interrupting capacities are presented in graphs and tables in Bulletin 3411. Twenty pages. HEINEMANN ELECTRIC CO.

406-Removable-tube heat exchanger data

Catalog 1156 gives design, capacity, and dimension data on removable-tube bundle Type R and RW heat exchangers. Sixteen pages. YOUNG RADIATOR CO.

407-Photoelectric controls fill many needs

Photoelectric controls described in Catalog 57 include controls for high-speed and impulse-actuated units. Units have fail-safe phasing, safety relays, warmup protection, photoelectric and electronic timing controls, and light sources with beam intensity adjustment. Sixteen pages. AUTOTRON, INC.

408-Power transformer manual

Transformer instruction manual covers installation, operation, component parts, maintenance, and inspection of power transformers in all ratings. Manual 427-R-1 is fully indexed. MOLONEY ELECTRIC CO.

409-How to mold your own refractories

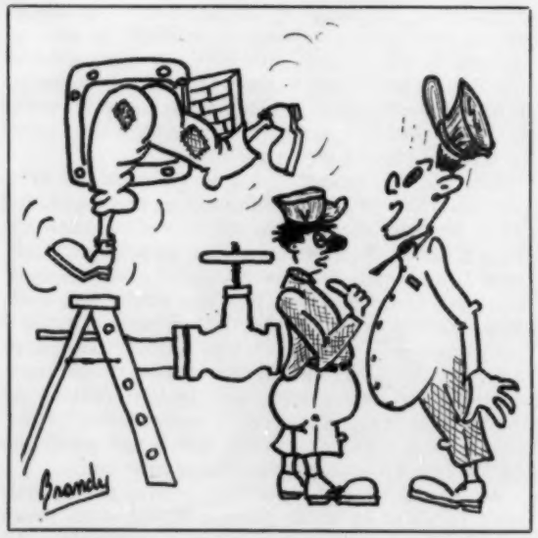
Bulletin describes R & I Moldit method of casting refractories. Includes working temperature, erosion resistance, weight and strength requirements, and recommended uses. Eight pages. REFRACTORY & INSULATION CORP.

410-Guide to shutoff valve selection

Design, use, and mechanical specifications of Sentry Full Flow valves are described in Bulletin 500. Includes valve cross section drawings. Four pages. COPPUS ENGINEERING CORP.

411-Pocket-size welder's encyclopedia

Here's quick reference source for welders and maintenance men. Covers welding, brazing, soldering, tinning, and cutting most commonly used metals. Discusses problems in joining dissimilar metals. Up to five copies free, extra copies 10¢ each. Fifty-two pages. ALL-STATE WELDING ALLOYS CO., INC.



"Why? Aint you never cleaned burners?"

. . . . submitted by A. H. Brandiff, Florida Power Corp., St. Petersburg, Fla.

412-Dual-fuel diesel engines

Bulletin 245 describes Nordberg Type TS-21 two-cycle engines. Includes section drawings of engine features. Force feed lubrication, straight-through scavenging, and fuel injection systems are described. Twenty pages. NORDBERG MANUFACTURING CO.

413-Aluminum insulation jacketing manual

Basic engineering data in illustrated manual aid in selecting, fabricating, and installing aluminum jacketing for tanks, vessels, and piping systems. Shows how to jacket tanks, vessels, straight piping, runs, fittings, and tank roofs. Forty pages. KAISER ALUMINUM & CHEMICAL CORP.

414-Gear motor selection data

Gear motors of ¼ to ¾ hp, 6 to 520 rpm, are described in Bulletin GEA-6133A. Includes selection charts with dimensions, ratings, and specifications. Eight pages. GENERAL ELECTRIC CO.

415-Data on elbow pressure losses

Folder F 7912 describes Uni-Flo Airturn air turning device. Handy performance data tables help you determine elbow pressure losses in air distribution system. Four pages. BARBER-COLMAN CO.

416-Traveling-grate stoker data

Case histories in Catalog 562 describe typical installations of J & J stokers with pertinent operating data. Catalog includes heat balance table and handy tabulation of standard stoker dimensions. Twenty pages. THE JOHNSTON & JENNINGS CO., DIV. OF PETTIBONE MULLIKEN CORP.

417-How to measure fluids accurately

Bulletin 18RG lists data on construction, and operation of SK Safeguard variable area rotameters for measuring fluid rate of flow. Includes tables of sizes and dimensions for the complete line. Twelve pages. SCHUTTE AND KOERTING CO.

418-How penetrant dyes locate flaws

Folder A-500E describes how Dy-Check dye penetrant aids in locating flaws in metals. Complete process is covered from precleaning operation to interpreting results. Chart gives recommended penetrating times for various materials. Four pages. TURCO PRODUCTS, INC.

419-Synchronous induction motor data

Synduction motors offer synchronous speed with induction-motor simplicity, in sizes to 40 hp. Available in drip-proof, splash-proof, totally enclosed, and explosion-proof designs. Bulletin 51B8440A lists many uses of this custom-built motor. Four pages. ALLIS-CHALMERS MANUFACTURING CO.

420-Solids-contact reactor handbook

Bulletin 5001 discusses theory and problems of cold water clarification. Includes photographs and drawings of solids-contact reactors. Includes section on auxiliary and supplemental apparatus. Twenty-four pages. COCHRANE CORP.

421-Flexible chain couplings handbook

Specifications, dimensions, and ratings for series DSC and series SA silent chain couplings and series DRC roller chain couplings are included in Catalog C45-56. Includes data on stamped steel covers, plastic covers and split aluminum covers. Sixteen pages. MORSE CHAIN COMPANY.

422-To help you determine convertor size

Capacity tables in Bulletin 50 simplify convertor selection. Separate section discusses convertors for radiant heating systems. Covers full line of series K (U-tube) steam-to-water convertors. Twelve pages. DAVIS ENGINEERING CORP.

423-Remove oxygen from feedwater

How to remove dissolved oxygen from boiler feedwater with Scav-Ox is described in illustrated booklet. Data includes dosage determination, application methods, and testing methods for hydrazine. Lists properties and procedures for handling the material. Case studies give operating data for using hydrazine in low-, medium-, and high-pressure boilers. Sixteen pages. OLIN MATHIESON CHEMICAL CORP.

424-How to patch with tape

Pocket-size Manual E-SIRB describes how to use Scotchrap pipe insulation tape to protect underground pipe from corrosion. Table lists recommended tape widths and tape overlap for various pipe sizes. Twenty-four pages. MINNESOTA MINING AND MANUFACTURING CO.

425-How to superclean atmospheric air

Case histories in Bulletin 557-D show use of Ultrafiltration cloth-filter-type dust collectors for dustfree atmosphere. Four pages. WHEELABRATOR CORP.

426-Gas analysis instrument guide

Use and operation of thermal conductivity analyzers for continuous gas analysis is described in Bulletin TD-507. Sixteen pages. ARNOLD O. BECKMAN, INC.

427-Alarm systems engineering data

Catalog 100B describes Panalarm annunciator system. Includes use, data on operating sequences, enclosures, mechanical specifications, remote equipment and components, and performance features. Thirty-two pages. PANELLIT, INC.

428-Quick-reference vacuum pump guide

Condensing and noncondensing jet vacuum pumps and boosters in 3-, 4-, and 5-stage units are described in Bulletin 5H3. Sizes, dimensions, and performance characteristics are given in quick-reference tables. Eight pages. SCHUTTE AND KOERTING CO.

429-Prefab pipe makes installation easy

Catalog 100 describes EBKC prefabricated underground and overhead insulated piping systems. Technical data includes flow tables, pressure drop curves, capacities, suggested piping specifications. Twenty-eight pages. E. B. KAISER CO.

430-How to order Class 2 fluid drives

Step-by-step instructions simplify ordering Gyrol Type T, Type TM, and Type VS Class 2 fluid drives. Bulletin 9119 includes chart of typical performance curves that compare starting torque, starting current, and heat generation characteristics. Sixteen pages. AMERICAN BLOWER CORP.

431-Diaphragm valve engineering data

Catalog 100 describes three basic types of valve operation. Gives engineering specifications for each. Twelve pages. HILLS-MCCANNA CO.

432-How power specialists handle projects

Organization and working methods of Fluor's Power Enginering Department is described in Bulletin 10[illegible] Company handles design and building of power plants, petroleum refineries, chemical and petrochemical plants, gas treating and processing plants. Twelve pages. THE FLUOR CORP., LTD.

433-Industrial fluorescent lighting data

Bulletin B gives data on 394 Benjamin industrial fluorescent lighting units. Describes lighting systems for general work-area lighting, for critical seeing tasks, for damp and humid atmospheres, and for hazardous locations. Easy-to-follow data tabulation speeds up lamp and accessory selection. Thirty-six pages. BENJAMIN ELECTRIC MFG. CO.

434-How to specify pipe insulation thickness

Special index based on "J" factor cuts computation time in determining pipe insulation thickness. Charts and tables show Unibestos physical and thermal characteristics. Forty pages. UNION ASBESTOS & RUBBER CO.

435-Protect low-voltage circuits

Bulletin 5042-A describes Cordon current limiting circuit breakers for 100,000 rms amperes protection of low voltage distribution circuits. Includes diagram showing typical uses, ratings, operational characteristic curve. Eight pages. I-T-E CIRCUIT BREAKER CO. ♦ ♦

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basic bulletins

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AIR CLEANING EQUIPMENT

550-Dust collectors manual

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrester types are the subject of a 32-page bulletin. Uses of air-conditioning, ventilating, conveying, drying, and cooling units are presented. KIRK & BLUM MFG. CO.

AIR CONDITIONING, HEATING, VENTILATING

500-Air-conditioning history

Development of air-conditioning units from earliest attempts to present-day techniques are discussed in Booklet "Why RK?". Booklet compares three installations as to costs, labor, materials, space. Thirty-six pages. UNITED STATES AIR CONDITIONING CORP.

BOILERS AND BOILER ACCESSORIES

501-Package boiler data

Bulletin AXY-1 describes Amesteam generator. Comes factory assembled. For 15 through 200 psi pressures. Seven pages. AMES IRON WORKS, INC.

505-Aluminum handbook

Boiler instruments to cover every phase of operation from water treatment to dust removal are described in Bulletin GSP-901. Twenty-six pages. HAGAN CORPORATION.

503-Steam cost calculator

Made of heavy board, this Steam Cost Calculator will enable you to read directly cost of steam per horsepower for installations using oil, coal, or gas. It also gives a direct reading of system efficiency. HAPMAN DUTTON CO.

504-Handbook on startup

Handbook covers washing out new boiler, putting it in operation, handling in service, firing methods, and shut down. Includes big section of everyday egnineering data. Forty-eight pages. TITUSVILLE IRON WORKS CO.

BUILDING CONSTRUCTION, MATERIALS

505-Aluminum handbook

"Alcoa Aluminum Handbook" describes complete line of aluminum forms, alloys, and physical properties. Covers fabrication into plate, wire, rod, tubular goods, electric conductor, structural shapes, and forgings. Includes tabular data on physical and chemical properties of all well-known alloys. 176 pages. ALUMINUM COMPANY OF AMERICA.

506-How to build better masonry

Recommended practice covering materials, proportioning, mixing, and laying of units is offered in Bulletin WP6.55-35M. Three essentials to better masonry and four essentials to better mortar are given with quantity reference tables. Twenty-four pages. UNIVERSAL ATLAS CEMENT COMPANY.

507-Complete data on nonshrink grout

Bulletin includes complete specifications and data on nonshrink grouting for heavy equipment, anchor bolts, building columns, and bridge seats. Specifications give recommendations on storage, mixing, forming, placing, and finishing. Contains data on strengths, cold- and hot-weather precautions, finishing edges, and removal of leveling devices. THE MASTER BUILDERS CO.

COMMUNICATIONS SYSTEMS

508-How to select industrial signals

Three major factors in signal selection are discussed in this bulletin: purpose of signal; areas to be covered; and noise levels to be overcome. Discusses general alarm, start and dismissal, coding or paging, and danger signals, for outdoor and indoor areas. Eight pages. FEDERAL SIGN & SIGNAL CORPORATION.

ELECTRIC DISTRIBUTION

509-Cable selection chart

Comprehensive selection chart for insulated electric cable is included in Bulletin 1096. Lists minimum standard industry specification requirements for each insulation and covering. Describes trade name insulations, their limitations, and correct installation methods. Sixteen pages. THE OKONITE COMPANY.

510-Cable raceway for every job

Raceways for cable and conduit for all installation problems are discussed in this bulletin. Globetray can be cut to any length and quickly installed. Complete set of standard fittings is available to permit change of direction or elevation. Horizontal elbows, inside and outside vertical elbows, tees, crosses, covers, and special fastening devices save installation time and labor. Load data are given for typical installations. Eight pages. THE GLOBE COMPANY.

551-Steel conduit manual

Description and specifications of rigid conduit in sizes from ½- to 6-inch nominal id are included in Bulletin 18-255. Contains data on size, weight, and physical properties of five types of steel conduit. Data tables list the number of conductors for different AWG or MCM specifications that can be run in different conduit sizes. Also lists advantages of 19 percent easier bending and 14 percent easier wire pulling through conduit. Eighteen pages. GENERAL ELECTRIC COMPANY.

552-Air interrupter isolator data

Bulletin 140 describes isolators for disconnecting equipment and cables in ratings up to 15,000 volts and

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NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

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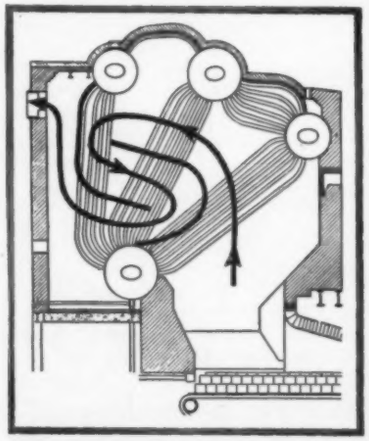

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1200 amperes. Bulletin lists points to be considered when ordering, shows typical applications, and gives dimension drawings, cutaways, and specifications for various types. Thirty-six pages. ELECTRICAL ENGINEERS EQUIPMENT CO.

553-Protect your circuits

Manual 101 lists 5 requirements for all circuit breakers to give full protection. Manual summarizes circuit breaker types, gives operating data on circuit breakers in many common uses. Sixteen pages HEINEMANN ELECTRIC CO.

ELECTRIC UTILIZATION

511-Dc motor guide to 200 hp

Shunt, stabilized shunt wound, compound wound, and series wound motors in eight enclosures are described in Bulletin 53B8424. Cutaway view and line drawings show construction details. Motor-generator sets for conversion from ac to dc also available. Six pages. ALLIS-CHALMERS MANUFACTURING CO.

554-Handy pocket charts

Charts for wire gauge and temperature conversion are available in a pocket-size Bulletin No. GEZ-1510. The bulletin is printed on durable plastic material in large easy-to-read type. GENERAL ELECTRIC COMPANY.

FUELS AND FIRING EQUIPMENT

512-New combustion sampling

Sampling system for continuous trouble-free sampling and oxygen measurement of combustion processes is described in Bulletin 703. Equipment is designed for steam generating plants, rotary kilns and driers, open hearth furnaces, tanks, and similar applications. ARNOLD O. BECKMAN CO., INC.

513-Read about fuel oil additives

How to get complete protection from fuel tanks to burner tips is described in Bulletin 5012-A. Additives eliminate desludging operations, keep screens and burners clean, improve atomization and combustion, eliminate smoke and soot, and reduce rusting, pitting, and leaks. Includes recommended amounts of additive per 1000 gallons of fuel oil. Four pages. DEARBORN CHEMICAL COMPANY.

HEAT EXCHANGERS

555-Heat exchanger operation

Air-flow diagram in two-page Data Sheet 124 graphically shows operation of the Aero Heat Exchanger for water, oil, or compressed air cooling. How the unit saves cooling water, piping, pumping, and equipment costs is explained. NIAGARA BLOWER CO.

INSTRUMENTS AND CONTROLS

514-Miniature bayonet thermocouple handbook

Miniature bayonet thermocouples can be used for engine and pump-cylinder heads, turbine housings, electric motors, generators, and transformers. Bulletin tells how to select proper thermocouples and adapters. Has guide to determin adapter length and thermocouple immersion length for a given hole depth. Ten pages. THERMO ELECTRIC CO., INC.

(more basic bulletins on page 44)

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basic bulletins

. . . starts on page 42

515-Selector guide for control systems

Package control systems for automatic oil, gas, and combination oil-gas burners are described in Bulletin CA-22. Concise selector guide aids in selecting the right panel control system. Sixteen pages. ELECTRONICS CORPORATION OF AMERICA.

516-Pocket-size thermocouple manual

Bulletin F 7255 is a convenient pocket-size reference manual for instrument men and engineers. Gives thermocouple temperature-millivolt equivalents. Temperatures are expressed on the International Temperature Scale of 1948, electromotive force in absolute units. WHEELCO INSTRUMENTS DIVISION, BARBER-COLEMAN COMPANY.

517-All-purpose rotameter handbook

Catalog describes indicating, recording, controlling, and integrating flowmeters for liquid and gas measurement. Contains dimensional installation diagrams. Capacities; corrosion-resistant properties; and unique features of full-view, armored purge meters, and research rotameter equipment are given. Sixty-eight pages. BROOKS ROTAMETER COMPANY.

LIGHTING

519-Fluorescent lamp handbook

"Fluorescent Lamps and Auxiliary Equipments," Technical Bulletin LS-101, gives complete data on the Circline, general line, Slimline, and rapid start lamps. Wiring diagrams, equipment for each type of lamp, and equipment for suppression of radio interference are included. Eight pages. APPLICATION ENGINEERING DEPT., LAMP DIV., GENERAL ELECTRIC CO.

LUBRICATION

556-Keep your oil clean

Frequent oil purification gives equipment longer life, reduces shutdowns, and maintenance cost. Includes engineering data on reclaimers, purifiers, and filters for many applications. One-hundred pages. THE HILLIARD CORP.

MAINTENANCE ITEMS

520-Manual on tool steels

Fourth edition of "Tool Steel Handbook" contains latest data on tool steels including types, properties, uses, and problems of working tools and high-speed steels. Includes handy reference tables. 204 pages. ALLEGHENY LUDLUM STEEL CORP.

521-Tube expanders, cutters data guide

Catalog 81 contains specifications and operating data on Ideal line of tube cutters, expanders, and accessories. Illustrated catalog is fully indexed for handy reference. Thirty-two pages. THE GUSTAV WIEDEKE CO.

522-How to specify steel tubing, pipe

Folder TDC-186 is a handy guide to help you determine proper uses of carbon, alloy, and stainless steel tubing, pipe, seamless welding fittings and flanges. ASTM and AAR specifications included. Four pages. TUBULAR PRODUCTS DIV., THE BABCOCK & WILCOX CO.

523-Packing and gasket buyers' guide

Catalog P-200C describes packing rings, piston cups, gaskets, braided and plastic packings, and asbestos sheet packing. Includes specifications on all packing types. Forty pages. RAYBESTOS-MANHATTAN, INC.

524-Stainless steel data book

Design and dimensional information on flange drilling templates, flange and ring-joint facings, stainless steel pipe, pipe threads, pressure-temperature ratings and conversion factors, resistance to fluid flow, hardness conversion tables, physical, and mechanical properties of stainless steel are covered. Selection chart for 300 corrosive solutions is included. Sixteen pages. COOPER ALLOY CORPORATION.

MATERIALS HANDLING (BULK)

525-Belt conveyor design handbook

Engineering data required to design a belt conveyor for any application are presented in 86-page Catalog 852. The booklet states that many problems can be answered by using a standardized unit. THE JEFFREY MFG. CO.

"Well, the boss agreed on a new compressor."

. . . . submitted by Arnold M. Hansen, Whirlpool-Seeger Corp., St. Paul, Minn.

526-Story of tile storage bins

"Vitrified Glazed Tile Industrial Storage Bins," four-page Bulletin 1153-B, tells you how this bin can keep materials clean, dry, and ready for use. KALAMAZOO TANK AND SILO CO.

HOW TO GET COPIES

To get a free copy of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on pages 47 or 48.

528-Conveyor belt slide rule kit

Two slide rules that cut the time required for designing a conveyor belt installation from 3 hours to 10 minutes are now available as part of a conveyor belt construction kit. One is a horsepower calculator, the other a carcass selector. They incorporate the engineering data in conveyor belting notebook. Forty pages. UNITED STATES RUBBER COMPANY.

MECHANICAL POWER TRANSMISSION

529-If speed is your problem

Booklet B-6727 gives speed reducer details including horsepower ratings, torque capacity, and overhung load values. Lists dimensions plus installation and maintenance information for single, double, and triple reduction. Reducers may be driven by electric motors, gas, oil, or diesel engines. Forty-four pages. WESTINGHOUSE ELECTRIC CORP.

530-Power transmission encyclopedia

Reference book covers base plates, bearings, chains, clutches, collars, couplings, keyseats, pulleys, shaftings, speed reducers, sprockets, takeups, and bushings. A special section is devoted to belts, drive tables, sheaves, and variable speed tables. 328 pages. DODGE MANUFACTURING COMPANY.

PIPING, TUBING, AND HOSE

531-Service guide to piping hookups

Pocketsize Bulletin M-71 gives data on correct piping hookups, methods of trouble-shooting, parts replacements. Drawings illustrate common installation errors. Sixteen pages. McDONNELL & MILLER, INC.

532-How to use expansion joints

Expansion joint design guide gives engineering application and selection data necessary to proper solution of pipeline expansion problems, shows schematic piping layout. Catalog 153 discusses various types of expansion joints on the market and includes a simplified selection chart. Twenty-four pages. FLEXONICS CORPORATION.

533-Piping flexibility analysis

Bulletin tells how to reduce cost of materials, design, and construction of processing and power piping systems. Includes development and solution of simultaneous equations for determining forces and moments in piping systems. Solves typical piping stress problem—high-temerature reheat system for utility central station—by both general analytical method and model test. Analyses permit specifications closer to the theoretically perfect pipe design. Twelve pages. FABRICATED PRODUCTS DIVISION, THE M. W. KELLOGG COMPANY.

534-Plastic pipe handbook

Bulletin describes threaded- and socket-type fittings and flanges in both normal and high-impact grades. Includes installation information, pressure-temperature charts, chemical resistance tables, and other reference data. Polyvinyl chloride pipe material is resistant to corrosion, inert, non-toxic, and light weight. TUBE TURNS PLASTICS, INC.

PUMPING EQUIPMENT

535-How to figure pump heads

How to determine total head against which pump must operate is only one of the valuable sections in Bulletin 353-1000 on the Bilton pump, a general purpose pump suitable for medium and low head service. Twelve pages. BYRON JACKSON PUMPS, INC.

536-General-purpose pump manual

Specific engineering data on more than 50 pumps are given in Form 7223-B. Describes pumps with capacities from 5 to 2800 gpm, with pressures from 10 to 525 feet total head. Cutaway view shows salient design features. Includes performance data on all pump types (including self-priming, end and side suctions) with electric, diesel, or gasoline-engine drives. Twenty pages. INGERSOLL-RAND CO.

557-Piston packing data

How to select the proper pump packing for your equipment is described in Bulletin 5503. Engineering data are included on the full range of Pumcup compositions, textures, and types available for specified pressure, temperature, and corrosive conditions. Color-coding for easy identification of the proper composition for many fluids are listed, including gases, acids, and alkalies. Tables of standard sizes from 1- to 20-inch od are also included. Sixteen pages. DARLING VALVE & MANUFACTURING COMPANY.

REFRACTORIES AND INSULATION

537-How to select refractory

"Boiler Refractories," 20-page Bulletin R-36, has been designed to provide operators of stationary and marine boilers with an authoritative guide for selecting the most efficient and economical refractories. BABCOCK & WILCOX CO., REFRACTORIES DIV.

SCHNEIBLE

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561-Refractory construction

The different types of construction considered standard for industrial refractory are described in Bulletin 39. Profusely illustrated. Twenty pages. BIGELOW-LIPTAK CORP.

538-Insulation, refractory handbook

Engineering data, formulas for calculating heat transmission, tables on heat losses from bare surfaces, and equivalent thicknesses of pipes are a part of the technical information contained in Bulletin IP-36A. Also includes descriptions of physical properties of the complete line of products. An excellent handbook containing information on all insulation and refractory problems. Fifty-two pages. JOHNS-MANVILLE.

TRAPS, STRAINERS, AND SEPARATORS

539-Get "bone dry" compressed air

Bulletin describes how ball-float trap eliminates all water and oil from compressed air system. Equipment is entirely mechanical and automatic. Requires no maintenance—has minimum working moving parts. Bulletin contains information on line of after-cooler-separator-filters. JAS. A. MURPHY & CO., INC.

TURBINES

540-Turbogenerators from A to Z

Turbogenerator construction, operation, and installation are discussed in bulletin. Includes condensing, condensing extracion, noncondensing, noncondensing extraction, and mixed-pressure extraction units with advantages and limitations of each. Cross section of typical turbine gives excellent understanding of all turbine components. Includes section on lubrication with recommendations for correct piping and accessories. Also shows cross section of typical generator with bearing, exciter, rotor, and shaft details. Thirty-six pages. WORTHINGTON CORPORATION.

VALVES AND REGULATORS

541-Automatic valve selection charts

Engineering data, flow charts, operating details, and illustrations of two-,three-, and four-way solenoid valves are included in Catalog 201. Unique selection chart enables you to quickly choose correct valve. Includes data on air, gas and stream flow. Thirty-two pages. AUTOMATIC SWITCH CO.

542-Butterfly valve data

Technical data in Bulletin B-2 are directed to all engineers responsible for handling and controlling large volumes of liquids or gases. Manual describes characteristics of rubber-seat butterfly valves, gives space requirements, and aids for valve selection. Includes conversion tables, pressure drop, and flow tables. Forty pages. THE HENRY PRATT CO.

(more basic bulletins on page 46)

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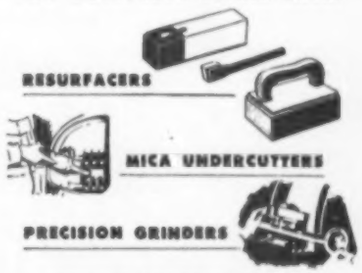

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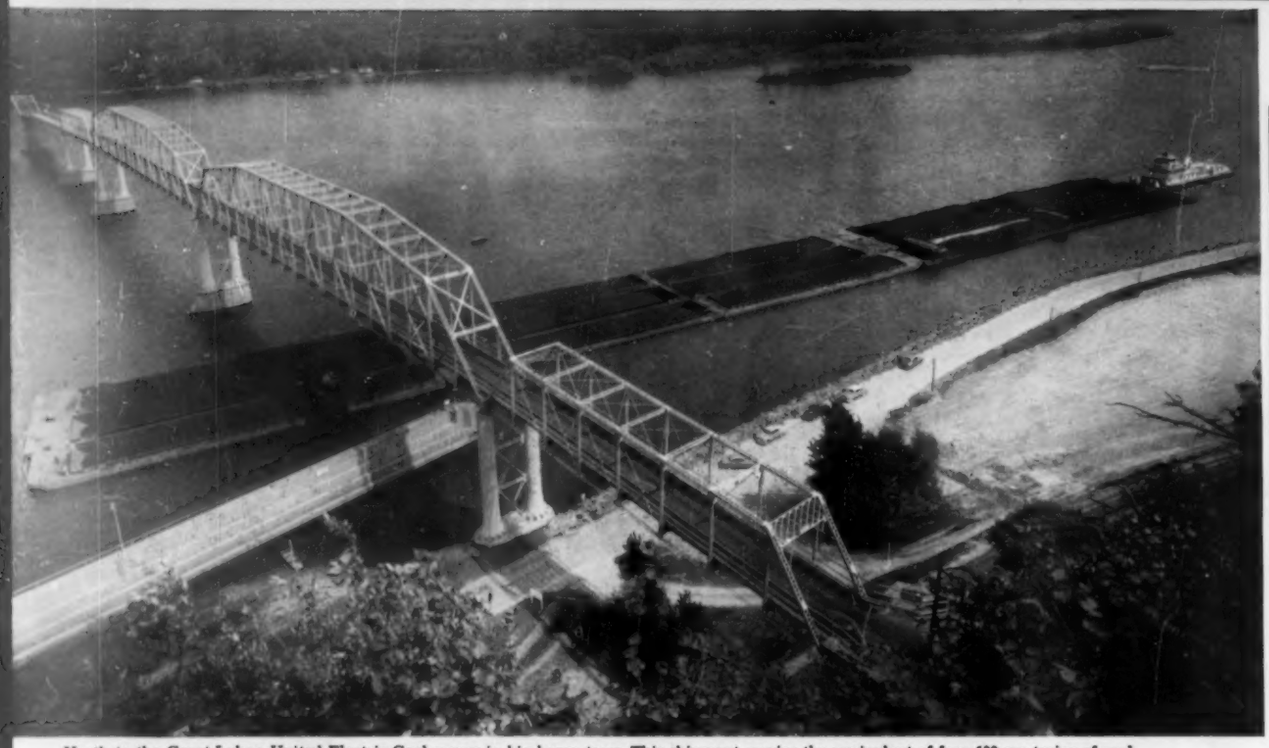

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basic bulletins

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543-Bronze solder-end valves

Solder-end globe, gate, and check valves are described in this circular. Valves are suited for offices, warehouses, and industrial buildings. Includes recommendations for use in steam, hot and cold water lines, heating and air-conditioning systems, oil, natural gas, and underground water lines. Seats permit repacking under pressure. THE LUNKENHEIMER COMPANY.

544-Valve comparison data

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545-General-purpose valve manual

Gate, globe, and angle valves in sizes from ¼ through 2 inches are described in Bulletin F-9, supplement 1. Also includes pressure-temperature rating chart for carbon and alloy steel valves. Dimensional-sectional views of 11 available valve configurations are given. Thirty-two pages. HENRY VOGT MACHINE CO.

WASTE DISPOSAL

547-Waste problems solved

How this company has solved waste treatment problems for such industries as electroplating, refinery, gas, and metal finishing is treated in detail in six-page Booklet 70-B. INFILCO, INC.

WATER SUPPLY AND TREATMENT

549-How to supply your own water

Methods of abstracting water from the ground or by infiltration through permeable beds of rivers or other bodies of water are discussed in 20-page bulletin. Performance charts for this company's collector are supplemented with cross-sectional drawings. RANNEY METHOD WATER SUPPLIES, INC.

559-Treating small water supplies?

Bulletin 5570 provides answers to many questions faced by small industries in treating water. Presents in easy-to-understand form principal well water impurities with recommendations for their removal. Discusses economics of treatment facilities with attention being given to possible expansion. Considers use of sedimentation basins and steel gravity filters with standard chemical feeds. GENERAL FILTER COMPANY. ♦♦

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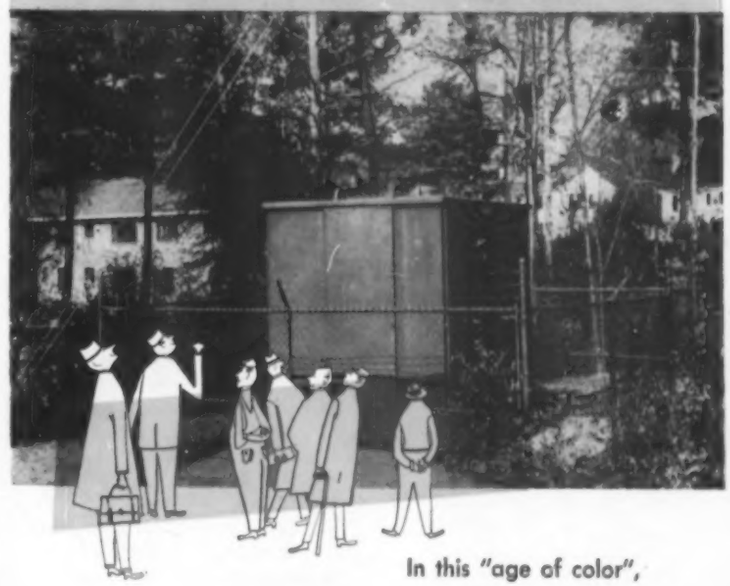

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. . . see page 52

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The Editors

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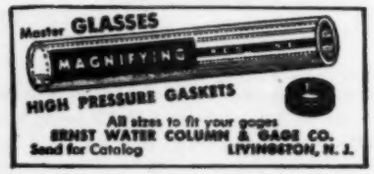

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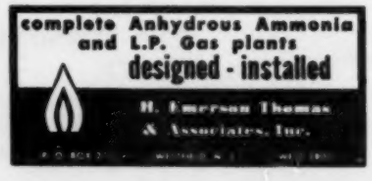

the LOCATOR

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OMAHA, NEBR.: Kay Engineering Co., 703 S. 24th St.
PORTLAND 9, ORE.: Pacific Pumping Co., 526 N. W. Broadway.
SAN ANTONIO 6, TEX.: San Antonio Machine & Supply Co., Box 660.
SAN FRANCISCO 7, CALIF.: Simonds Machinery Co., 816 Folsom St.
SALT LAKE CITY, UTAH: The Lang Co., 267 W. First St.
SEATTLE 99, WASH.: Pacific Pumping Co., 114 W. Harrison St.
TULSA 3, OKLA.: Hako-Hearn Engineers, 201 Enterprise Bldg.
WACO, TEX.: San Antonio Machine & Supply Co., Drawer 148.

AURORA PUMP DIV. OF NEW YORK AIR BRAKE CO. .....Page 26

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BIRMINGHAM 5, ALA.: Haydn Myer and Co., Inc., 1107 Seventh Ave., South, 4-5645.
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LOS ANGELES 22, CALIF.: Westco Pump Sales Co., 4621 Sheila St., ANgelus 2-1155.
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W. H. & L. D. BETZ .....Page 9

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BIGELOW-LIPTAK CORP. .....Page 29

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BUELL ENGINEERING CO. .....Page 38

NEW YORK, N. Y.: 70 Pine St.

BYRON JACKSON PUMPS, INC. ....Page 56

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LOS ANGELES 54, CALIF.: Box 2017, Terminal Annex.

DARLING VALVE & MFG. CO. .....Page 34

DALLAS, TEX.: PRospect 3423.
DENVER, COLO.: MAin 8022.
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EUREKA, KANS.: 60.
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DEARBORN CHEMICAL CO. .....Page 20

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ECONOMY FUSE & MFG. CO. .....Page 25

CHICAGO 14, ILL.: 2717 Greenview Ave.

ENGINEER CO. .....Page 43

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ERNST WATER COLUMN & GAGE CO. .....Page 41

LIVINGSTON, N. J.: 252 S. Livingston Ave.

FEDERAL SIGN & SIGNAL CORP. ..Page 30

CHICAGO 19, ILL.: 8700 S. State St.

L. B. FOSTER CO. .....Page 46

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GENERAL COAL CO. .....Page 23

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GLOBE CO. .....Page 33

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SAN FRANCISCO, CALIF.: The Squires Company, 370 Fourth St., YUkon 6-4882.
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GUYAN EAGLE COAL CO. .....Page 36

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HUNGERFORD & TERRY, INC. .....Page 27

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HOUSTON, TEX.: H. O. Knape, 811 Waugh Drive, JAckson 8-2896.
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IDEAL INDUSTRIES, INC. .....Page 45

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ILLINOIS WATER TREATMENT CO. ..Page 44

ROCKFORD, ILL.: 840 Cedar St.

INFILCO, INC. .....Page 2

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I-T-E CIRCUIT BREAKER CO., SWITCHGEAR DIV. .....Page 8

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BIRMINGHAM, ALA.: Jos. W. Eshelman & Co., Inc., 1812 28th Avenue, South, Homewood, P. O. Drawer 5768.
BUTTE, MONT.: R. E. McDonough Company, 829 Maryland Ave., Box 278.

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the LOCATOR

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DALLAS 5, TEX.: Box 8085.
DENVER 3, COLO.: 655 Broadway Bldg., Room 410.
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HOUSTON 6, TEX.: Box 6466, 2032 Dunlavy St.
JACKSON 5, MISS.: Gregory-Salisbury & Co., Inc., 429 South West St., Box 1089.
LITTLE ROCK, (PINE BLUFF) ARK.: Gregory-Salisbury & Co., Inc., P. O. Box 673.
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TUCSON, ARIZ.: Central Station Equipment Company, 2323 Aviation Highway.
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JOHNS-MANVILLE CORP. .....Page 7
NEW YORK 16, N. Y.: 22 E. 40th St.

JOHNSON SERVICE CO. .....Pgae 39
MILWAUKEE 2, WIS.: 509 E. Michigan St.

THE KIRK & BLUM MFG. CO. .....Page 37
DENVER 23, COLO.: Landis, Zachary & Peterson, 275 Kalamath St., MA 3-6203.
NEW ORLEANS, LA.: Mid-South Sales, 4424-B Earhart Blvd., TUlane 4683.

NATIONAL AIROIL BURNER CO. ....Page 38
PHILADELPHIA 34, PA.: 1350 E. Sedgley Ave.

MONARCH ELECTRIC CORP. .....Page 28
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NEFF & FRY CO. .....Page 41
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NEW YORK & NEW JERSEY LUBRICANT CO. .....Page 42
NEW YORK 17, N. Y.: 292 Madison Ave.

NIAGARA BLOWER CO. .....Page 44
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PALMER THERMOMETERS, INC. ....Page 37
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SEATTLE 4, WASH.: Fairman B. Lee Co., 219 Central Bldg., EL 3582.
TULSA 9, OKLA.: Arduser & Co., Box 4267, GIbson 7-8311.

PRAT-DANIEL CORP. .....Page 43
See Thermix Corp.

RELIANCE GAUGE COLUMN CO. ...Page 11
ALBUQUERQUE, N. MEX.: Steel & Engineering Products Company, 1609 Second Street, N.W., Box 8026, Station "C".
BIRMINGHAM 9, ALA.: Joseph W. Eshelman & Company, 1812-28th Ave., S. Homewood.
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SOUTHERN COAL CO. .....Page 10
CHICAGO 1, ILL.: Prudential Plaza.

SPRAGUE ELECTRIC CO. .....Page 27
BATON ROUGE, LA.: Gregory-Salisbury & Co., 4445 Sweetbriar St.
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SAN FRANCISCO, CALIF.: C. E. Ingalls & Sons, 541 Monadnock Bldg.
SEATTLE, WASH.: Shaffer & Nelson, 312 Occidental Ave.
SPOKANE 10, WASH.: Shaffer & Nelson, P. O. Box 198.

STANDARD PRESSED STEEL CO. ....Page 26
JENKINTOWN 39, PA.: Stewart & Kenmore Ave.

HERMAN H. STICHT CO., INC. ....Page 24
NEW YORK 7, N. Y.: 27 Park Place.

SUBOX, INC. .....Page 49
AMARILLO, TEX.: The Williamson Sales Company, Box 3508.
BEAUMONT, TEX.: The Williamson Sales Company, Box 3164.
BIRMINGHAM, ALA.: Walter E. Thompson, 447 American Life Bldg.
CORPUS CHRISTI, TEX.: The Williamson Sales Company, Box 65.
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THE SUPERIOR ELECTRIC CO. ....Page 4
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SEATTLE, WASH.: Rm. 830 Central Bldg., 810 3rd Ave.
VAN NUYS, CALIF.: 14663 Titus St.

THERMIX CORP. .....Page 43
ALBUQUERQUE, N. MEX.: Landes, Zachary & Peterson, P. O. Box 3245.
DENVER 23, COLO.: Landes, Zachary & Peterson, 275 Kalamath St.
EL PASO, TEX.: Landes, Zachary & Peterson, 312 East Missouri St.
GRAND JUNCTION, COLO.: Landes, Zachary & Peterson, P. O. Box 396.
HOUSTON 1, TEX.: The J. A. Rossiter Co., P. O. Box 1095.
LOS ANGELES 7, CALIF.: Southport Engineering Co., 235 West 32nd St.
NEW ORLEANS 12, LA.: Arlesco Company, Inc., 1221 Carondelet Bldg.
SALT LAKE CITY 10, UTAH: The Lang Company, Inc., P. O. Box 479.
SAN FRANCISCO 11, CALIF.: The Fulcher Co., 24 California St.
SEATTLE 4, WASH.: Fairman B. Lee Co., 219 Central Bldg.
TULSA 5, OKLA.: Vanco Engineering Co., P. O. Box 7222.

UNITED ELECTRIC COAL COMPANIES .....Page 51
CHICAGO, ILL.: 307 N. Michigan Ave.

WESTERN PRECIPITATION CORP. ..Page 31
LOS ANGELES, CALIF.: (Main Office) 1026 W. 9th St.
SAN FRANCISCO, CALIF.: Hobart Building.

EDWIN L. WIEGAND CO. .....Page 34
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YARNALL-WARING CO. .....Page 6
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LOS ANGELES (PASADENA), CALIF.: 380 East Green St., Room No. 305, RYan 1-7511.
SAN FRANCISCO 10, CALIF.: 2300-26th St., VAlencia 6-2165.
SEATTLE, WASH.: Aurora Business Center, 4003 Aurora Ave., Room 209, MElrose 9094.

ZIMMERMAN PACKING CO. .....Page 35
DALLAS 7, TEX.: Giller Tool Supply Co., Inc., 159 Leslie St.

coming events

. . . for industry power

Dec. 5-7	IRE Instrumentation Conference and Exhibit	Biltmore Hotel, Atlanta
Dec. 9-12	AIChE Annual Meeting	Statler Hotel, Boston
	1957	
Jan. 21-22	Association for Applied Solar Energy Symposium	Hotel Westward Ho, Phoenix
Jan. 21-25	AIEE Winter General Meeting	Hotel Statler, New York City
Jan. 23-24	Engineering Institute on Industrial Lighting	University of Wisconsin, Madison
Jan. 28-31	Plant Maintenance & Engineering Show	Cleveland
Feb. 18-21	Industrial Ventilation Conference	Kellogg Center, Michigan State University, East Lansing
Feb. 18-22	ASCE Sectional Meeting	Jackson, Miss.
Feb. 25-Mar. 1	ASHAE International Exposition	International Amphitheatre, Chicago

send in your

cartoon ideas

Ever run across situations in your plant that gave you a real chuckle? Share those situations with your fellow readers of INDUSTRY POWER. We will send you $5 for every cartoon idea accepted, $10 per finished cartoon sketch accepted. (Sketches must be in black ink on heavy white paper, about six inches by six inches square.)

Just two conditions apply: Cartoon ideas must pertain to the power services, and they must be in good taste. Otherwise, the field for your cartoon ideas is wide open. Send along your ideas and sketches to

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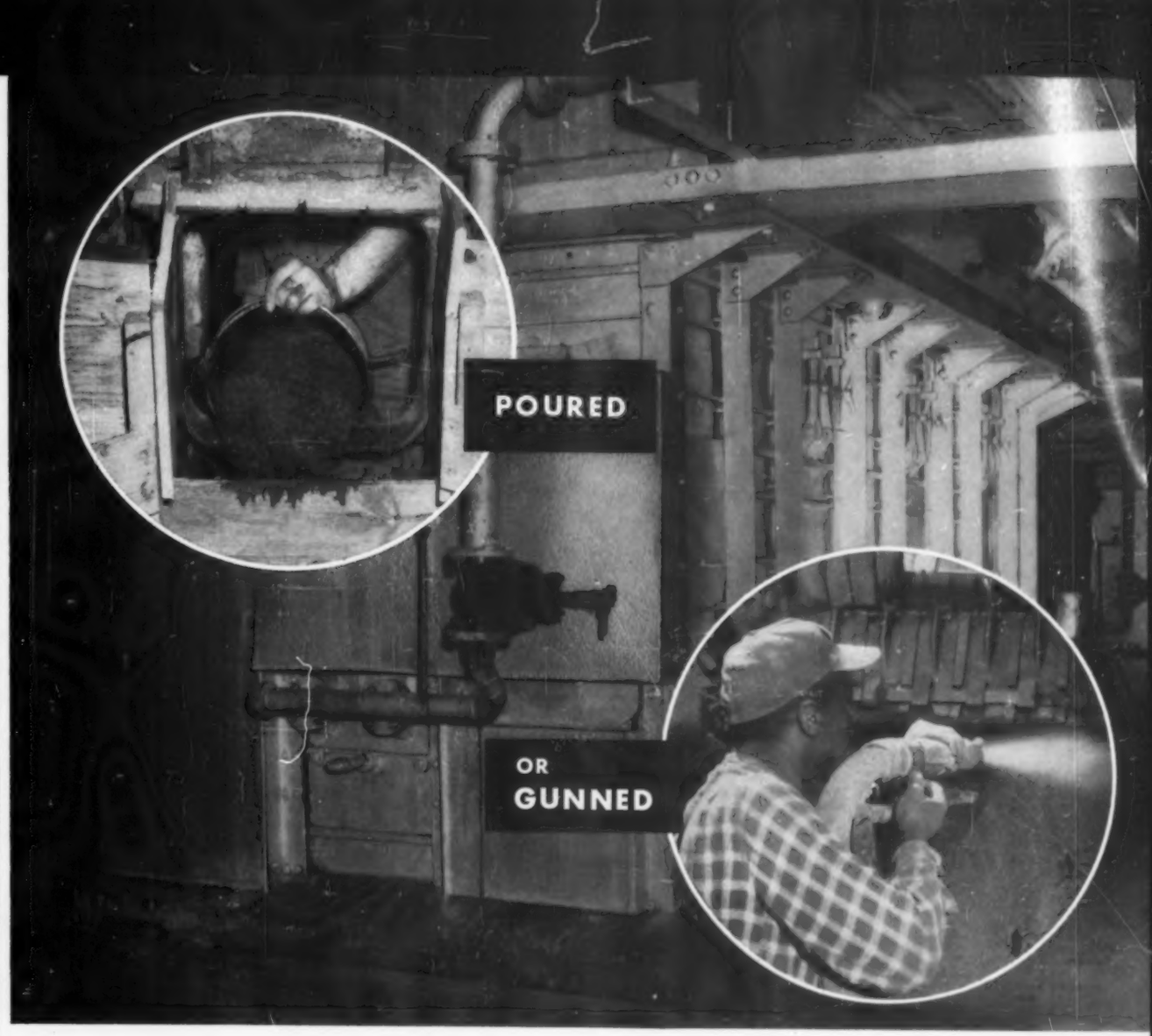

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Send for Bulletin R-40 which gives data on B&W Kaocrete Refractory Castables for lining ashpits.

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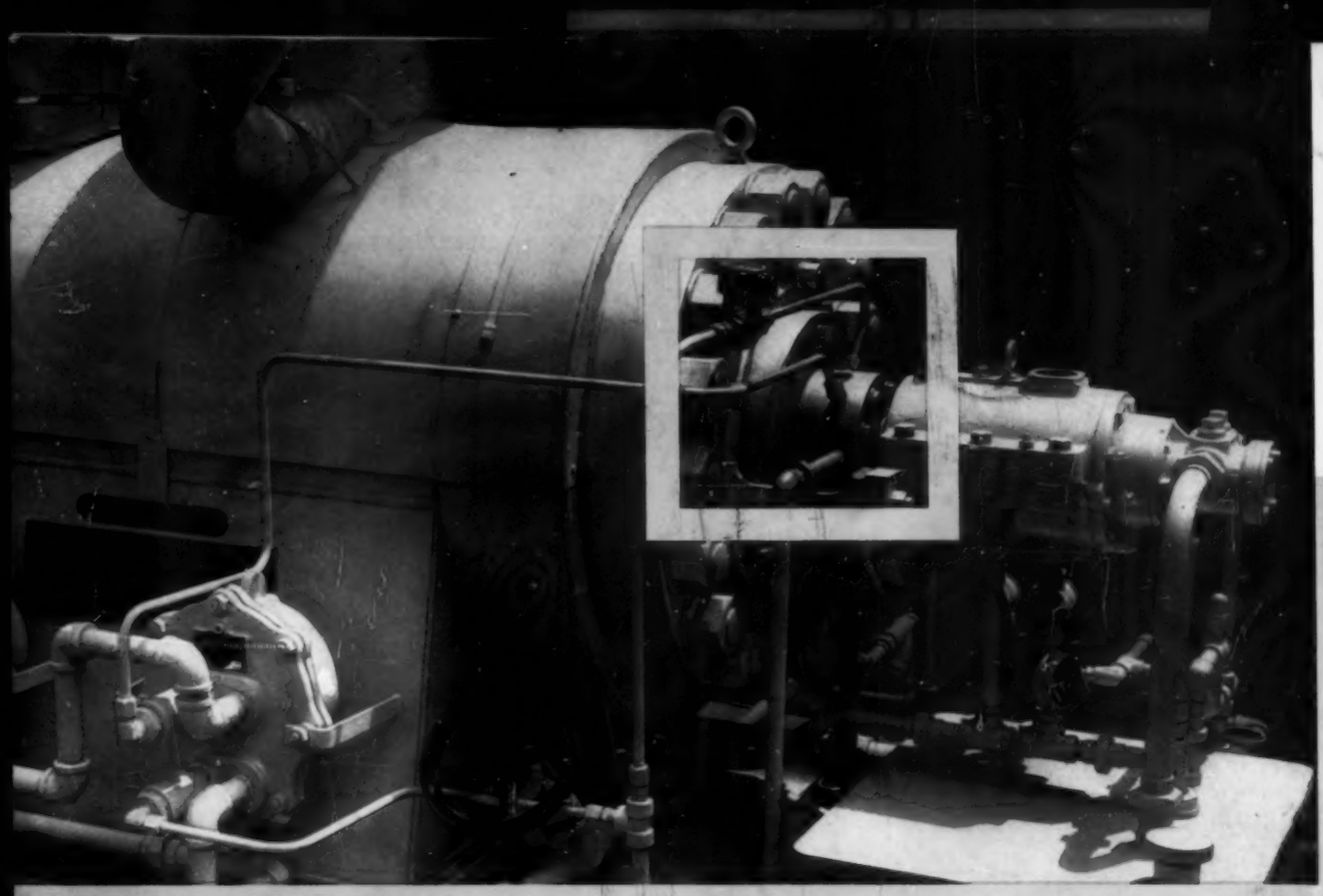

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